AN ANALYSIS OF REAL GROWTH OF ELECTRONICS INDUSTRY DURING 1975-80

DISSERTATION SUBMITTED IN PARTIAL
FULFILMENT OF THE REQUIREMENTS
FOR THE AWARD OF THE DEGREE OF
MASTER OF BUSINESS ADMINISTRATION

BY
MOHD. NASEEM

UNDER THE SUPERVISION OF
Mr. Kaleem Mohd. Khan
M. B. A.
Lecturer

DEPARTMENT OF BUSINESS ADMINISTRATION
ALIGARH MUSLIM UNIVERSITY
ALIGARH (INDIA)
1982

[redacted]eem Mohd. Khan

DEPTT. OF BUSINESS ADMINISTRATION
[redacted]LIM UNIVERSITY

Dated. 10.11.1982.

Certified that Mr. Mohd. Naseem of M.B.A (Final) ha s completed his dissertation entitled"AN ANALYSIS OF REAL GROWTH OF ELECTRONICS INDUSTRY DURING 1975-80" under my supervision.

I am satisfied that the work is based on the investigations made and data collected by him.

(Kaleem Mohd. Khan)
Supervisor

ACKNOWLEDGEMENTS

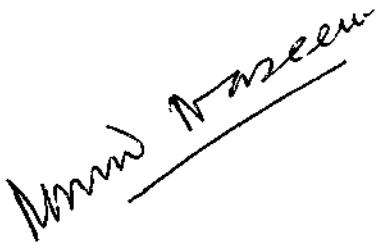
In the preparation of this dissertation I received help from various sources. I wish to express my deep sense of gratitude to Mr. Kaleem Mohd. Khan, my supervisor, for his unfailing help and guidance.

My thanks are also due to Mr. Rajveer K. Sameul, Asstt. Marketing Manager, Weston Electroniks Limited, for his help and guidance.

I feel grateful to various members of the Department of Electronics, New Delhi, in collecting data for this study.

I wish to thank Prof. Hafiz-ud-Din, Chairman, Department of Business Administration, A.M.U., Aligarh, for his valuable suggestions.

My thanks are also due to Mr. Q. Javed Ahmad for the efforts he put in typing this dissertation.



ALIGARH, 1982.

(MOHD. NASEEM)

CONTENTS

****

INTRODUCTION

Electronics has assumed the role of providing a forceful leverage to the socio-economic as well as technological growth of human society. It is one of the latest growing industries and also it has the potential of leapfrogging in the national development in view of its ability to deliver techno-economic multipliers. Today, electronics pervades virtually all spheres of activities with increasing sophistication from entertainment equipment and household gadgets to voice and vision broadcasting, telecommunication, automobiles, industrial control, weather forecasting, etc. Further, today, defence equipment has a heavy content of electronics. It is, therefore, important to have a strong electronics base in any country.

Electronics industry was in a state of infancy at the time of India's independence. At that time, there existed only a few units capable of assembling radio receivers and that too with practically imported components. In addition to radio units, the activities of the Post and Telegraphs and Railway departments represented an additional aspect, though in a limited way, of the activity in electronics. Since then, it has not only grown in total volume but has also diversified enormously. In the initial years of development of this industry, consumer electronics products dominated the market, but of late professional electronics systems are becoming increasingly important. The share of profesional

electronics in the electronics production was 46 per cent in 1971 which grew to 57 per cent in 1975 and their share was 53 per cent in 1980. The growth in the production of electronics industry during the period 1975 to 1980 is summarised in Table 1. The total production of electronics items increased from Rs. 3,640 million in 1975 to Rs. 7,895 million in 1980, (excluding SEEPZ production) recording a compound growth of 16.7 per cent in financial terms on the basis of current prices.

In the year 1973, following rapid increase in oil prices, both the wholesale and consumer price indices rose sharply. The prices of finished goods drifted upward and wages displayed sharp increase. The inflationary impact due to increase in oil prices stabilised around 1975. However, since then there has been a significant price increase in all types of manufacturing inputs, intermittent increase in oil prices and as a result the production costs have gone up. The electronics industry requires a diverse variety of raw materials, component parts, components, sub-assemblies, etc. The prices of these commodities have increased considerably. A wide variety of raw materials for the electronics industry continues to be imported. Because of the general inflation prevailing in the world, Indian import bill is rising. Import of basic raw materials from Japan and West European countries, where inflation rate is very high, has become costly. This has made a considerable impact on the prices of finished goods. As a result it has been observed that valuewise production has been showing much higher increasing trend as compared to growth in physical terms. Therefore, an analysis of the growth in production during

Table 1. Growth in the production of electronic industry.

Year	Production (in Rs. million)	Growth rate (%) at current prices
1971	1,760	-
1975	3,640	19.9
1980	7,895	16.7*

*Growth with respect to 1975 production. The production of SEEPZ is not included.

the last six years based on the current prices during a particular year will give an apparent growth pattern. It would, therefore, be worthwhile to estimate the production of electronics industry in real terms since 1975. In order to have an idea of the real growth in production during the period 1975-80, the production statistics should be normalised with respect to the prices prevailing at 1975. In addition to this, the impact of changing technology pattern alongwith its effect on final prices must be taken into consideration.

This report aims to analyse the impact of inflation on the growth of electronics industry and to determine the real growth in production during 1975-80. A good deal of discretion has necessarily been exercised in the interest of making the analysis simple. For example, while estimating the inflation, no account of price variation in individual items, specialised products in all sectors of electronics industry, has been taken. The issue of inflation in the public enterprises of central government or state governments, may be different from the private investment units. The main

difference lies in that the private ~~section~~ sector produces goods for sale whereas with some public sector enterprises products, e.g. telecommunication/defence equipment, this may not be the case. In the latter cases, problem arises of estimating the factors responsible for inflation which are generally not encountered in small scale and even in organised sectors units. The present analysis report is expository in nature and is divided into five sections. Section II describes the growth of production during the period 1975-80. The factors influencing the growth of electronics industry are analysed in Section III. In section IV, a detailed analysis of the real and apparent growth of electronics industry has been carried out. Important conclusions of the analysis are briefly lighted in the concluding section.

Table 2. Production profile of electronics industry (1975-80) at current prices (value in Rs. million)

Serial No.	Clendar year	Components	Consumer electronics	Communication equipment and mass communication	Aerospace and defence equipment	Control instruments and industrial electronics	Computers and calculators	Equipment (total)	Equipment + Components
1.	1975	750	820	995	490	400	185	2,890	3,640
2.	1976	800	1,010	1,120	500	475	165	3,270	4,070
3.	1977	905	1,290	1,275	550	885	170	4,140	5,045
4.	1978	1,170	1,575	1,275	620	989	201	4,660	5,830
5.	1979	1,360	1,790	1,285	605	1,099	211	4,990	6.350
6.	1980	1,630	2,140	1,845	680	1,306	295	6,265	7,895
Compound growth rate (%)		16.8	21.1	13.1	6.8	26.8	9.7	16.7	16.7

II. GROWTH FOF ELECTRONICS INDUSTRY AT CURRENT PRICES DURING 1975-80

The electronics industry has grown to a level of production of Rs. 7,895 million (excluding SEEPZ production) in 1980, with the production of a wide diversity of products ranging from components, consumer items, process control instrumentation systems to computers and communication systems. Table 2 shows the production profile of electronics industry from 1975 to 1980 and the growth rates for each of the sectors. It is apparent from the table that various sectors the electronics industry have grown at different growth rates, but the overall industry achieved a growth of 16.7 per cent. A profile of production of electronics industry is depicted in Fig. 1.

Though the production capacities for a wide variety of consumer electronics items, components and professional equipment was established by 1980, the production is yet to be stabilised. The output of some sectors has risen more rapidly, the production of others less rapidly, than the total output. Some products that once freely drew the consumer attention are declining. Other products that were unknown in earlier decade are today an integral part of the electronics industry. The production based on indigenous knowhow has increased. There is a growth of small scale sector and geographical spread of industry. Presently, there are about 150 units in the organised sector and about 2,000 units in small scale sector engaged in the production of varieties of equipments and components. The production is shared by public

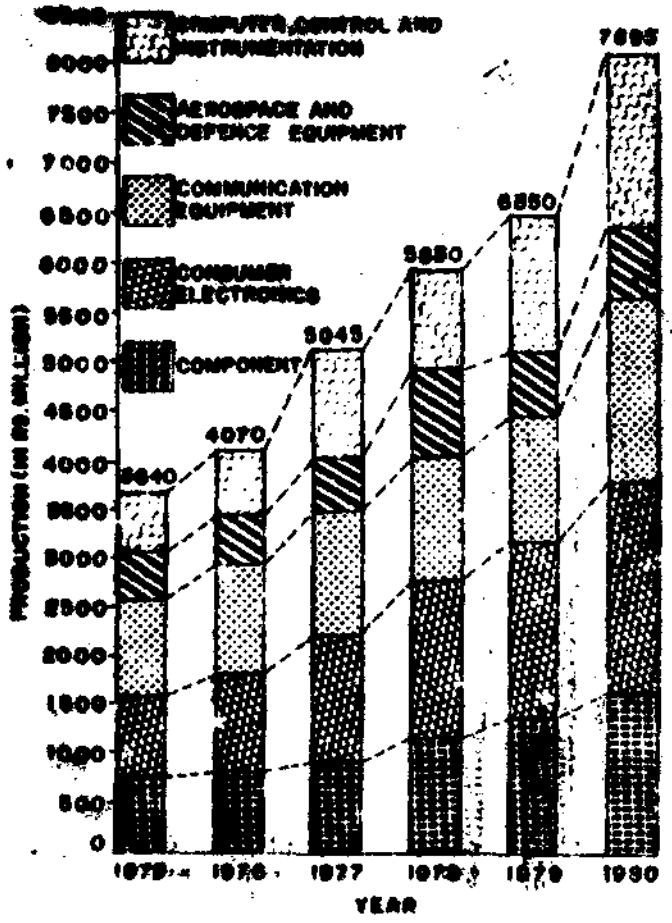


Fig 1 Production profile of electronics industry

as well as private sector companies. Most of the units in the public and organised private sectors are producing defence, communication and capital intensive instruments and components whereas small scale sector is involved in the manufacture of assembly-oriented electronics products, However, the relative growth of small scale sector is gradually increasing e.g. the share of small scale units production in electronics industry has increased from 22 per cent in 1975 to 28 per cent in 1980.

There are, at present, 9 major central public sector undertakings which are contributing towards the production in the electronics industry. Out of the total production of Rs. 7,895 million in 1980, the share of major public sector units is about Rs. 2,875 million. The production of all public sector units on an average has increased by approximately 60 per cent during this period. However, the growth rate of production from units like HTL and HAL is low. BEL is the major producer of TV tubes, semiconductor devices and electron tubes. Apart from the defence equipment, it has been the supplier of studio and transmitting equipment to all India Radio and Doordarshan. ECIL is the manufacturer of computers and nuclear instruments. The production range of ITI is telephones and allied products while teleprinters are produced by HTL. Instrumentation for power stations are manufactured by Instrumentation Ltd., Kota.

Growth Rate of Electronics Industry and Individual Sectors:

It is apparent from Table 2 that the growth rates in an individual sector is quite different from the growth rate of total electronics industry. For example, CIIE sector rose rapidly with

a growth rate of 26.8 per cent, followed by consumer electronics with a rate of 21.1 per cent. These two sectors together grew more rapidly than the industry as a whole. However, the production in thetelecommunications and aerospace and defence equipment was almost stagnant during the period 1976-79,

The overall growth pattern of the electronics industry is shown in Fig. 2. The tapering off in the slope of the curve indicates that the growth rate has been increasing. The growth has displayed considerable variation in the rate of increase from year-to-year, especially expansion has been followed by a period of consolidation. The picture of growth is production during particular sub-period is quite different from the picture of entire period viewed as a single unit. Thus the terminal years on which the growth is estimated, may lead to bias and misleading results, e.g., a growth rate obtained would look very different if the terminal years were 1974-79 than if the terminal data were of 1975-80. Therefore, to avoid this pitfall in measure of growth rate, it will be appropriate to take into account the production of preceeding and suceeeding year - before arriving at a growth rate.

The growth pattern is, therefore, drawn to the dates by taking moving average of production for 3 years i.e., the average of production of 1974, 1975 and 1976 is taken to be production for 5. Similarly, average of production of 1975, 1976 and 1977 1977 it taken to be production for 1976 and so on. The production of 1980 is averaged by the index as obtained for the earlier years. The growth patterns so obtained for the aggregate electronics industry and individual sectors are shown in Fig. 2.

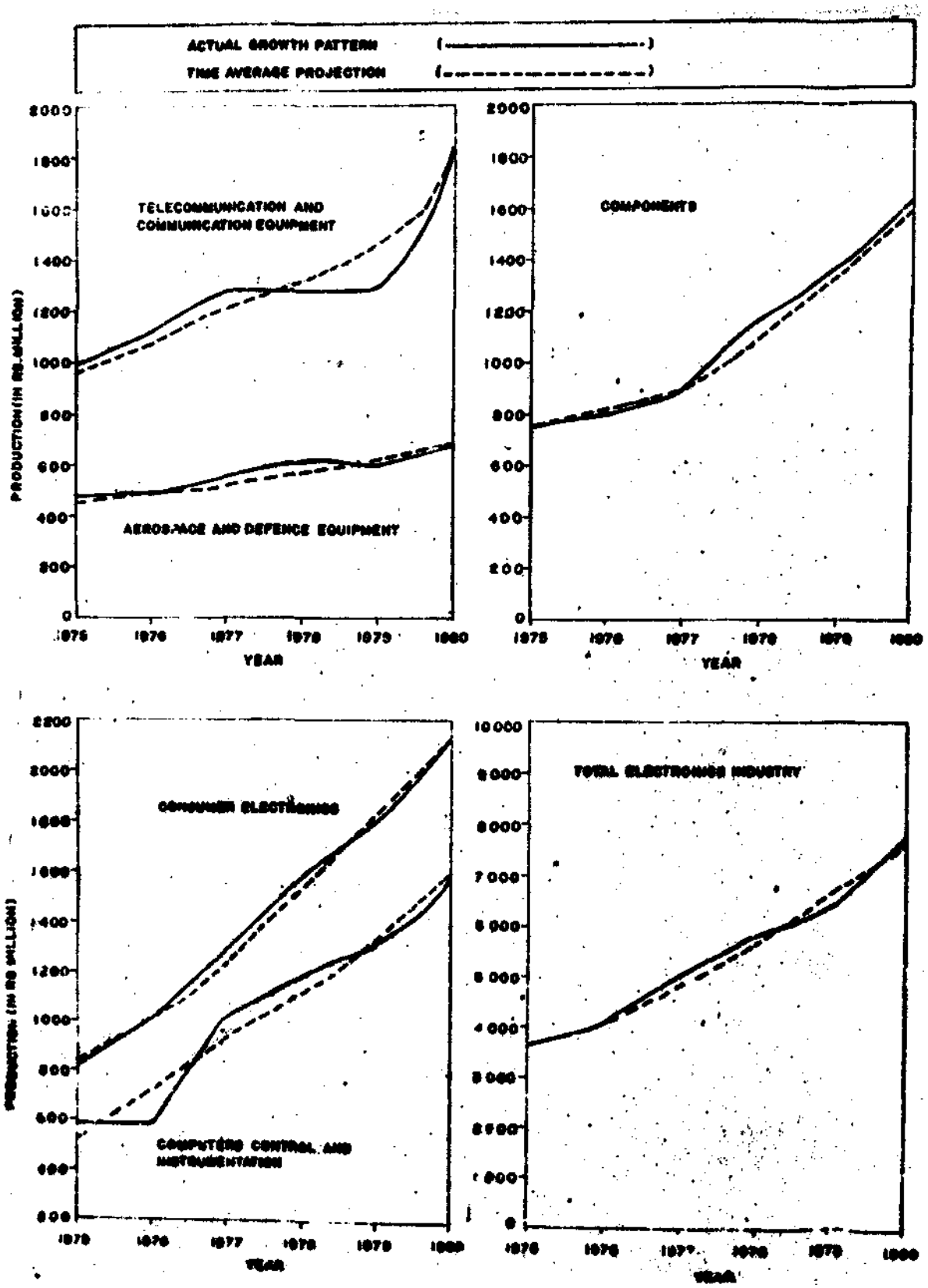


Fig 2 Time average fitting of growth pattern of various sectors of electronics industry

To have an idea of magnitude of shift in growth rates due to seasonal variation, the growth rates of aggregate electronics industry and individual sectors estimated from curve 1,2 of Fig. 2 are compared in Table 3.

Production Trends in Individual Sectors of Electronics Industry:

a) Components: The production of components which was worth Rs. 390 million in 1971, grew to Rs. 750 million in 1975 and further increased to Rs. 1,630 million in 1980. In comparison to a growth of 16.7 per cent in equipment production during the last six years, the components production has grown at a compound rate of 16.8 per cent during the same period. Now almost all categories of components, namely, electron tubes, semiconductor devices, passive components and electromechanical components are being manufactured in India. Though most of the production is for usage in consumer electronics products, but a beginning has been made for the professional components also. The present trend is towards the production of high quality components with competitive prices.

The value-wise growth in the production of four broad categories of electronic components is given in Table 4. This data shows that different categories of components have grown at different growth rates. In the case of electron tubes and semiconductor devices the growth rates are less than the growth rate of the total components industry. While for passive components including loud speakers, crystals, magnets and ferrites, the growth rate is much more than the average growth rate. Electromechanical and miscellaneous components have grown almost at the growth rate of components industry. The reasons for different growth rates

Table 3. Comparison of actual growth rates of various sectors of electronics industry with those projected by moving average method at current prices.

Sl. No.	Sector	Growth rate (%)	
		Actual (curve 1)	Average estimated (curve 2)
1.	Components	16.8	16.3
2.	Consumer electronics	21.1	20.0
3.	Telecommunication and mass communication	13.1	14.0
4.	Aerospace and defence	6.8	6.6
5.	Control and instrumentation	22.0	23.5
6.	Aggregate electronics industry	16.8	16.9

Table 4. Valuewise growth in the production of electronic components during 1975-1980.

Sl. No.	Component category	Production (in Rs. million)		Compound growth rate (%)
		1975	1980	
1.	Electron tubes	98	168	13.6
2.	Semiconductor devices	159	292	12.9
3.	Passive components (resistors, capacitors, crystals, permanent magnets, loudspeakers and ferrites)	200	523	21.2
4.	Electromechanical and Other components (including TV deflection components, TV tuners and tape recorders)	293	629	16.5
	Total	750	1630	16.8

for different types of components are specific to them. For example, most of the growth in the electron tube area has come due to a large increase in the production of TV picture tubes which accounts for nearly 56 per cent of the electron tube output in 1980, compared to only 40 percent in 1975. The year-wise production data in terms of value at current prices and in terms of numbers for some of the selected components since 1975 is given in Table 5. The compound growth rates are also given in this table. In the following paragraphs, the growth patterns of major component categories are discussed.

1) Electron Tubes: At present, six major types of tubes, namely, receiving tubes, transmitting tubes, TV picture tubes, micro-wave tubes, cathode ray tubes and X-ray tubes are being manufactured in India. The total production of electron tubes has increased from Rs. 98 million in 1975 to Rs. 180 million in 1980 showing a compound growth rate of 13.6 per cent. It may be observed from Table 5 that production of receiving valves has fallen from 4.88 million numbers in 1975 to 2.81 million numbers in 1980, whereas monetary-wise there is increase in production. The production of TV picture tubes which was 70,000 numbers in 1975 decreased to 55,000 numbers in 1976, but thereafter its production increased rapidly and reached upto a level of 0.26 million picture tubes in 1980. As a result of import duty concession given by Government in 1976, the price of picture tube decreased substantially. Because of this, growth rate in monetary terms (22 per cent) is less than the growth in physical numbers (30 per cent).

The production of transmitting tubes was 7,100 numbers in 1975 and since 1976, it has been varying between about nine thousand

to ten and a half thousand numbers. During this period growth in the production of CR tubes is significant, increasing from 800 numbers in 1975 to 3,340 numbers in 1980, thereby showing a growth of 33 per cent. In the case of microwave and X-ray tubes the growth was 6.8 per cent and 13.1 per cent in terms of ~~quality~~ quantity and 11.4 per cent and 23 per cent in terms of value (Appendix-I).

2) Semiconductor Devices: The production pattern on a yearly basis for transistors, diodes and integrated circuits, for the years 1975-1980, is given in Table 5. It is observed that the production of all types of semiconductor devices has increased from Rs. 159 millions in 1975 to Rs. 292 millions in 1980 with a growth rate of 12.9 per cent. The production of transistors and deodes which was 59.40 million numbers in 1975 fell in 1976 and thereafter it increased rapidly and reached a level of about 104 million in 1980, registering a compound growth of 11.8 per cent. The production of integrated circuits picked up at a rate of 17 per cent during 1975-80. A significant price reduction has also been noticed during this period. In addition to these, production for different types of power devices was established and the per unit price of each device has been fluctuating during the last few years due to the fact that the production has not yet stabilised.

3) Passive components: The items which are taken in this category are all types of resistors and capacitors, loud speakers, crystals, soft and hard ferrites and permanent magnets. The year-wise production of these components from 1975 to 1980 is given in Table 5 and Appendix-I. The total production of passive components increased from Rs. 200 million in 1975 to Rs. 523 million in 1980, registering

Table 5: Growth in the production of some selected components (only organised sector) during 1975-80 (Value in Rs. million, quantity in million numbers).

Sl. No.	Components		1975	1976	1977	1978	1979	1980	Compound growth rate (%)
1.	Receiving tubes	Qty.	4.88	3.63	3.83	3.95	3.11	2.81	- 12
		Value	35.40	30.64	33.51	40.07	34.53	38.60	1.8
2.	TV picture tubes	Qty	0.070	0.055	0.091	0.142	0.200	0.260	30
		Value	38.74	26.72	39.97	57.14	82.26	104.51	22
3.	Transistors and Diodes	Qty.	59.40	62.91	65.00	77.25	92.58	103.66	11.8
		Value	130.14	102.87	129.73	147.83	178.63	215.28	10.0
4.	Integrated circuits	Qty.	0.217	0.272	0.409	0.610	0.747	1.03	17
		Value	6.15	6.49	8.27	9.87	15.52	21.29	28
5.	Carbon fil resistors	Qty.	135.92	128.32	169.12	167.1	114.52	138.95	0.4
		Value	12.46	10.90	13.32	17.49	15.44	16.06	5.2
6.	Electrolytic capacitors	Qty.	12.79	15.10	17.61	25.60	31.11	31.03	19.4
		Value	16.49	19.25	24.24	39.60	58.01	66.03	32
7.	Plastic film capacitors	Qty.	33.40	36.24	46.85	51.53	49.30	53.93	10.1
		Value	15.75	18.97	23.87	36.04	43.61	51.76	27
8.	Gang condensers	Qty.	1.64	2.87	3.13	3.26	3.06	2.85	11.7
		Value	8.84	16.32	17.32	24.81	24.46	27.31	25
9.	Permanent magnets	Qty.	217.6	224.5	273.0	279.0	240.2	218.1	0.1
		Value	19.84	22.25	30.92	36.9	55.88	63.07	28
10.	Hard ferrites	Qty	186.6	267.9	404.1	466.5	775.2	936.3	38
		Value	5.06	7.12	10.51	12.20	19.21	24.67	37
11.	Loudspeakers	2.06	2.74	3.02	3.15	3.18	2.45	3.50	3.5
		Value	23.81	26.30	30.30	41.40	42.02	40.89	11.4
12.	Connectors	0.44	0.31	0.35	0.27	0.45	0.45	0.70	0.70
		Value	11.24	10.49	12.59	12.70	22.31	24.91	17.30
13.	Relays	Qty.	0.51	0.52	0.94	0.10	0.92	0.83	10.2
		Value	11.46	12.09	17.07	19.72	30.6	15.23	5.9

a compound growth rate of 21.2 per cent. The compound growth rates for the production in terms of numbers and value for passive components show that the production in terms of value has grown at a much faster rate as compared to growth in physical numbers. This indicates that there is a large increase in prices of passive components during this period.

The production of carbon films resistors has remained almost stagnant except for the years 1977 and 1978 when there was increase in production. The growth in the case of metal film resistors and potentiometers was 17.8 percent and 8 percent respectively in terms of numbers. The production of electrolytic capacitors in the organised sector has shown a growth of 19.4 per cent during 1975-80. The growth rate was between 10 to 12 per cent for plastic film, tantalum and gang condensers. The production of ceramic capacitors has grown at a very slow rate during this period. The production of permanent magnets is not growing. However, its place is being taken over by hard ferrites, the production of which has grown very rapidly during the last six years.

4) Electromechanical and Other Components: The main electromechanical components are connectors, relays and switches. There is a large type diversity in this category and much of its production is in the small scale sector. The growth in the production of electromechanical components in the organised sector can be seen from Table 5. In addition to these, a large number of other components like TV deflection components, TV tuners, tape recorders magnetic tapes, microphones, micromotors, magnetic heads, cartidges, stylli, printed circuits boards, transformers, coils etc. are

being manufactured in India. The total production of electro-mechanical and other components has increased from Rs.293 million in 1975 to Rs.629 million in 1980, thus showing a growth of 16.5 per cent. There has been a substantial increase in the prices of some of these components due to the increase in the prices of basic raw materials used for manufacturing them. The prices of TV deflection components and TV tuners have come down over these years.

b) Consumer Electronics: The production of consumer electronics has grown from Rs.820 million in 1975 to Rs.2,140 million in 1980, at current prices, registering an overall growth of 21.1 per cent The production pattern of consumer electronics items in terms of numbers and value for the period 1975 to 1980 is given in Table 6. The increase in production of this sector has been a result of simultaneous growth of all its subsectors and the production base has been widened. In addition to radio receivers, TV receivers, taperecorders, calculators, items like video tape-recorders, CCTV systems, electronic watches and clocks are also being produced in India now. However, the two items, namely, radio receiver and TV receiver continue to account for 80 per cent of the production in this sector. The growth of the different subsectors in the last six years is briefly discussed in the following.

1) Radio Receiver: The production pattern on a yearly basis, for radio receivers for the years 1975 to 1980 is given in

Table 6. The manufactures of radio receivers have largely diversified the range of products, at present it extends from one band MW sets to multiband - stereo tuners, car radios, clock radios, radio-cum-recorder, etc. The production of radio receivers is both in small scale sector and organised sectors. The large share of production in small scale sector is towards cheap MW pocket sets and 2 band radio sets having ex-factory value less than Rs.165. MW radio sets costing less than Rs.70 are readily available now. However, the units in the organised sector, are concentrating on expensive sets.

2) Television Receiver: The production of TV receivers increased from 97,000 sets in 1975 to 3,69,000 sets in 1980 with the small scale sector dominating in the total production. The number of units in production has increased from 40 in 1975 to 54 in 1980. During the years 1975 and 1976, TV industry grew at a smaller pace, the price of TV sets were high and the demand was low. The models of different sizes were available in market. However, as a result of significant import duty concession provided by the government on TV glass shells and differential excise duty in 1976 and 1977, the price of TV sets was reduced by about 30 per cent. The production of TV receiver has then grown rapidly. The production of TV receivers in terms of physical numbers and value is given in Table 6.

3) Tape Recorder: The production of tape recorders has increased from 50,000 sets in 1975 to 3,02,000 sets in 1980. In monetary terms, the production has grown from Rs.35 million

Table 6. Year-wise production of consumer electronics items during 1975-80 (quantity in thousand numbers; value in Rs. million).

Sl. No.	Items	1975	1976	1977	1978	1979	1980	Compound growth rate (%)
1.	Radio receiver							
	Quantity	2520	2980	3760	4420	5130	5812	18.2
	Value	410	479	596	737	827	965	18.2
2.	TV receiver							
	Quantity	97	143	239	270	311	369	30.7
	Value	210	315	460	523	611	725	28.0
3.	Tape recorder							
	Quantity	50	70	113	151	179	302	43.5
	Value	35	37	65	99	107	168	37.0
4.	Record player							
	Quantity	138	119	129	131	153	142	0.4
	Value	45	49	60	67	78	83	4.5
5.	PA system	124	139	143	145	151	154	4.5
	Value	70	99	101	112	112	136	15.9
6.	Miscellaneous							
	Value	50	31	54	37	55	63	4.8
	Total consumer electronics	820	10101	1290	1575	1790	2140	21.1

to Rs.168 million during the same period. The production in this subsector is mainly confined to small cassette type recorders. However, items like car cassettes and stereo cassette recorders are also being produced. This industry has gained momentum only during the last two years because of availability of indigenous components like tape deck mechanism and the prices have been reduced considerably. At present, cassette tape recorders are available in the market in the range of Rs.350 to Rs.1,000.

4) Record Player: Because of the emergence of TV sets and tape recorders as a popular medium of entertainment, the growth rate of record player industry has been low. The production profile of record players from 1975 to 1980 is shown in Table 6. The major production in this sector is from organised sector accounting about 70 per cent of the total production.

5) Amplifier and PA System: The organised sector does not play any significant role in amplifier and PA systems as these industries are reserved for small scale sector. The production profile of amplifier and PA systems is given in Table 6. The units operating in this subsector have shown competence both in manufacturing good quality products and in exports.

Large number of other consumer electronic products being manufactured are CCTV systems, electronic watches, video games, digital clocks, TV booster amplifiers, etc. The production of these products has started in the last two or three years and shared by both organised and small scale sectors.

c) Telecommunication: Currently, nearly one quarter of the total production of electronics in India is in the field of telecommunications. A profile of production in the elecommunication sector is given in Table 2.

The growth in this sector has occured at a far from even rate, e.g. the production increased by about 44 per cent between 1979 and 1980, while there was only a slight increase in production during 1976 to 1979. In view of this virtual stagnation, the share of telecommunication equipment in the total elecronics production which was 28 per cent in 1975 has reduced to 23 per cent in 1980. Among the items now being manufactured are telephones, teleprinters, exchange line equipment, PABX, PBX equipment etc. The entire production of telecommunication equipment is in public sector undertakings like ITI, BEL, HTL, ECIL and Workshop of P & T etc. The production of some of the telecommunication equipment items in terms of value as well as in physical numbers, for the period 1975-1980 is given in Table 7.

The study of Table indicates that increase in production in terms of numbers, is comparatively less. For some items like cross bar exchange system and strowger exchange system, the physical growth is negligible. This suggests that growth in production in the area is purely due to rise in prices of instruments and equipment.

Table 7. Production of some items of telecommunication sector during 1975-1980
(quantity in thousand numbers; value in Rs. million)

Sl. No.	Products	1975	1976	1977	1978	1979	1980	Compound growth rate (%)
1.	Teleprinter							
	Quantity	518	6.75	5.50	7.50	6.40	8.60	10.7
	Value	31	43	36	38	44	61	14.5
2.	Telephone							
	Quantity	364	534	420	386	430	454	4.5
	Value	75	125	146	117	148	142	13.6
3.	Strowger exchange							
	Quantity	140	138	150	160	140	143	Negligible
	Value	219	185	246	261	255	376	11.4
4.	Cross bar exchange							
	Quantity	112	93	110	98	98	950	-3.5
	Value	160	161	184	185	179	225	7.1

d) Aerospace and Defence Equipment: The production of aerospace and defence equipment has increased from Rs.490 million in 1975 to Rs. 680 million in 1980. The production profile is shown in Table 2. The growth in production of this sector which is on user tied basis, if of same nature as of telecommunication and communication equipment sector. A virtual stagnation has been observed in the production during the last six years. In terms of value, the growth rate of production in aerospace and defence equipment during 1975 to 1980 is only 6.8 per cent.

e) Control, Instrumentation and Industrial Electronics (CIIE) :

CIIE represents a major growth area of electronics industry. This sector is fairly broad and covers discipline like process control instruments, industrial electronics, medical electronics and test and measuring instruments. An idea of growth in production of this sector is given in Table 2. It is seen from the Table that whereas the electronics equipment production increased by two times during 1975-1980, the production of CIIE, in the same period registered nearly three fold increase. In 1975, the CIIE production constituted 14 per cent of total equipment production, in 1980 its contribution towards the total equipment production increased to an impressive 21 per cent. The growth in this sector has essentially come from the introduction of new devices, induction of new technology and development of new items. The industry is fairly well spread and production units are of composite nature producing wide varieties of instruments. The large share of production (about 75 per cent) is

from organised sector. Within the organised sector, the production of private sector is significantly higher than that of public sector. The base for production of CIIE varies with its constituents; for test and measuring instruments, the manufacturing base is mainly concentrated in the small scale sector. The instruments manufactured in this category are like digital multimeter, oscilloscope, admittance bridge, pH meter, spectrophotometer, etc. The production of nuclear instruments like GM counter, pulse analysis equipment, reactor control equipment is mainly concentrated at ECIL, Hyderabad. The production of medical electronics comes from small and medium scale manufacturers both in public and private sectors, of the equipment manufactured, X-ray equipment constitutes the major share. Unlike medical electronics, the production in process control equipment is dominated by organised sector. The types of instruments produced cover a wide variety of numerical control machines, temperature measuring devices using mercury, resistance and pyrometric methods, etc.

f) Computers: In India, the computer industry is basically a new industry, which has come up during the last five or six years. The indigenous production is only of medium and small computers and large systems are being imported. The production of computers and calculators during the period 1975-1980 is given in Table 2. Untill 1977, the Indian computer scene was dominated by two foreign companies IBM and ICL which have now closed down their operations. These companies were operating

in India for over two decades in activities like refurbishing of old equipment, sale of new system, manufacture of punch cards, key punches, etc. The indigenous production of computers was started by ECIL around 1971 and later on a number of private sector and state public sector units also entered into the indigenous development and production of microprocessor based controlled subsystems involving minimum peripherals. The production in computer industry depends on a large extent on foreign technology and imported components. The weakest link of the industry is peripherals where the production is marginal and major share of requirement at present is being imported.

g) Calculators: The production of calculators in real terms started around 1975 and during the last six years its production has increased 8 times. Initially the desk calculators were manufactured but now production of hand held 4 to 6 function model is more. The cost of pocket calculators with 4 to 6 functions which was as high as Rs.400 in 1975 is now Rs.150. This is due to availability of low cost integrated circuits.

III. FACTORS AFFECTING GROWTH OF ELECTRONICS INDUSTRY

Developing countries like India have been severely hit by inflation. The impact of inflation has many direct and indirect effects on the growth of industrial production. Almost in every industry the inflation has given an upward swing to prices which has impeded, the growth. For example price escalation in oil and diesel has contributed significantly to the increase in prices of all sorts of commodities. The price rise has led to increase in wage and salary bill and a consequent rise in production costs.

The manufacture of electronics goods require a diverse variety of raw materials like metals, non-metals, semiconductor materials, chemicals, plastics, ceramics, glasses, etc. The prices of these materials have increased considerably during the last five or six years. In addition to increase in prices of raw materials, there are several other factors which have led to increased cost of a final product. The various factors that inhibit the growth of electronics industry are identified as follows.

(i) Increase in the cost of indigenous/imported raw materials
(ii) Import duty on finished and unfinished goods
(iii) Increase in wage and salary bill due to increase in consumer price index
(iv) Increase in cost of primary energy
(v) Increase in interest rates on credit

(vi) Increase in transportation cost in general due to increase in fuel prices

(vii) Technological changes

(viii) Other miscellaneous factors, like increase in the rates of postage, telephones, advertisement, etc.

The impact of the factors on the electronics industry is briefly discussed below.

Increase in the Cost of Raw Materials: The general inflation leads not only to increase in prices but also cause scarcity of materials. The cost of raw materials used for electronics industry has shown volatile price movement over the last decade especially during the last five or six years. The trend in prices of some of the selected materials is shown in Table 8, 9 and 10. Materials especially dependent on petroleum.products have registered increase in prices by a large factor. In view of the general inflationary trend throughout the world, the silicon and other high grade semiconductor materials have become costlier. The raw materials for capacitors have gone up by approximately 65.75 per cent. Aluminium foils have registered an increase of 70 per cent. The prices of tin and copper wire used for wiring in equipment, as resistors lead and in most of the passive components has increased by about 40 per cent during the last five to six years.

Import Duty: Indian electronics industry for various reasons, still depends to an appreciable extent on import of various raw

Table 8. Wholesale price index of some raw materials in 1975-76 and 1979-80.

Sl. No.	Category	1975-76	1979-80	Percentage Change.
				666
1.	Iron and Steel	183.5	258.5	41
2.	Glasses and ceramics	22.1	282.2	27
3.	Petroleum products	700.3	1384.0	98
4.	Basic metals and alloys	187.3	256.8	37
5.	Non-ferrous metals and alloys	198.7	251.6	27

Table 9. Increase in prices of some non-ferrous metals (Price in Rs. per 100 kg).

Sl. No.	Item	1975	1980	Percentage increase (1975-80)
1.	Allumiumi	875	1560	78
2.	Copper	2650	3925	48
3.	Tin	15700	20600	81
4.	Lead	785	1680	114
5.	Zinc	1200	1400	20

Table 10. Price change in some fine chemicals during 1975-76 to 1981-81 required by electronics industry (value in Rs.)

Sl. No.	Item	Quantity	1975-76	1980-81	Percentage increase
1.	Acetone analar	1 litre	30.40	50.20	65
2.	Acetic acid analar	500 gm	16.00	22.00	37
3.	Ammonium chloride analar	500 gm	14.00	20.00	43
4.	Benzene analar	1 litre	31.90	40.00	28
5.	Chromic acid	1 kg	57.00	82.00	44
6.	Hydrochloric acid	500 ml	14.00	18.00	38
7.	Hydrofluoric acid	500 ml	27.00	35.00	30
8.	Methanol analar	1 litre	30.20	40.00	32
9.	Nitric acid analar	500 ml	17.00	25.00	47
10.	Toulene analar	500 ml	18.00	30.00	67
11.	Xylene analar	2.5 lire	92.65	125.00	35
12.	Trichloroethylene	1 litre	47.50	85.00	79

materials, components and capital equipment. High import duties levied on the imported items tend to increase the prices of finished products. It is normally observed that duty on raw materials is higher than that on the finished goods/products. Sometimes the higher duty rates are levied to protect indigenous industry but with comparatively inferior quality and non-availability of indigenous materials easily, it makes an adverse impact on the growth of electronics industry (Table II).

In addition to high import duties, the devaluation of Indian currency also has made the import costlier. Capital goods have been affected maximum in this context. The effect of devaluation is more pronounced in the case of most of West European goods.

Wage and Salary Bill: The wholesale and consumer price index has increased considerably during the last ten years. A general trend in wholesale price indices and consumer price indices are shown in Table 12. The rising trend in prices from 1970-71 to 1974-75 was high, the prices increased by about 12 per cent annually. From 1975-76 to 1977-78, the price rise was moderate, and relatively stabilised. However, from 1978-79 onwards, the rising trend in prices is extraordinarily high. The electronics industry is considered to be labour intensive as compared to other engineering industries and many of the manufacturing activities in the industry are assembly oriented. Because of the rapid increase in consumer prices index, during the last

six years, there has been a considerable increase in wages of industrial workers. In the case of large public sector units manufacturing electronics equipment, the overall rise in wage bill has been to the order of 40 to 50 per cent. This has reflected in the cost of production of components and systems depending upon the manhours required to manufacture them.

Increase in the Cost of Primary Energy: The primary energy requirements of the electronics industry are quite negligible as compared to other industrial sectors of economy. The majority of the equipment manufacturing activities are assembly oriented. In the case of components, semiconductor manufacturing requires relatively large amounts of electric power for diffusion furnaces, etc. The manufacture of electron tubes and TV picture tubes also need large amount of energy for annealing and glass making. The electricity rates have increased on an average by 40 to 50 per cent in every state during the last six years. Besides the production of electronics industry has suffered because of power shortage/cuts in almost all over India.

Increase in Interest Rates on Credits: In accordance with the government policy on control and squeeze on credit, the interest rates on the finance available to industry, have been revised upward from time to time. Whereas the interest rates on finance available to small scale industrial units changed from 10 to 14.5 per cent during the last six years the organised sector has to avail the finance at higher rates of interest which have increased

Table 11. Import duty on some selected items of raw materials, components and equipment of electronics industry.

Sl. No.	Item	Rate of import duty (basic)	
		1975	1980
1.	Electromedical apparatus	60	89
2.	Loud speakers	100	137
3.	Electrolytic capacitors	60	137
4.	Silicon wafers	60	45
5.	Carbon film resistor	60	137
6.	Transistors and diodes	100	137
7.	Wirewound resistors	100	137
8.	Computer peripherals	100	119
9.	Instruments (test and measuring)	60	89

Table 12. General trend in prices since 1970-71 dn average to average basis.

Sl. No.	Average for the financial year	Sholesale prices (base 1970-71=100)		Consumer prices (base 1960- 100)	
		Index	Percentage change	Index	Percentage change
1.	1970-71	100.0	-	186.0	5.1
2.	1971-72	105.6	5.6	192	3.2
3.	1972-73	116.2	10.0	207	7.8
4.	1973-74	139.7	20.2	250	20.8
5.	1974-75	174.9	25.2	317	26.8
6.	1975-76	173.0	1.1	313	1.3
7.	1976-77	176.6	2.1	301	3.8
8.	1977-78	185.8	5.2	324	7.6
9.	1978-79	185.8	-	331	2.2
10.	1979-80	216.8	16.7	360	8.8
11.	1980-81	256.0	18.1	400	11.1

Source Statical Organisation (Central)

from 15 to 19 per cent during this period. The interest rates on term loan required for purchase of capital machinery and fixed assets have increased more than the working capital. The increased rates of interest have made the production costlier. In the consumer electronics sector where the investment is low, return of money is fast, the effect of increase of interest rates is small as compared to capital intensive areas like components, telecommunication, aerospace and CIIE sectors.

Increase in the Cost of Transportation: The increase in the oil prices has many direct and indirect effects on the economy. It has resulted in an increased transportation cost on an average by more than 100 per cent, which has affected prices at every level. Although there has been an overall increase in prices of many of electronics products, the effect of increase in oil prices on electronic items is relatively small as compared with the other industries like chemicals, fertilisers, etc., which are petroleum based.

Technology Changes: The development and growth of electronics industry depend upon to a large extent on the advancement and innovation in technology. During the last six years, there has come about a qualitative change in technology. There is a switch over from hybrid circuitry to integrated and micro-processor based circuit technology. The number of memory bits and logic functions per chip has increased 10 times during the last six years. One large scale integrated circuit (LSI) today

is equivalent to several thousand transistors in functional terms. In going to higher level of integration certain categories of components must obviously show a fall in demand. In the case of equipment, the technology of integration i.e. going upto LSI level, has led to reduction in the cost of components going into them, increased productivity, increased stability, more space and energy saving designs. The increase in equipment production is then marked by price reduction. Another important advancement in technology which has come in the last few years is that the analogue devices and systems are now becoming increasingly digital. Displays for digital systems allow direct indication and reading of numbers, letters and symbols, and can present more data in less space than the analogue meters. Display devices have extremely low costs as compared to analogue meters, e.g., prices of LED, LCD which are being used extensively in digital equipment like electronics calculators, measuring instruments and other products have come down considerably during the last few years due to the improvement in manufacturing technology. As a result of the improvement in technology there is a continuous improvement in product performance and capability.

The other miscellaneous inflationary tendencies like increase in postage, telephones and advertisements rates have also raised the cost of publicity and marketing expenses. Some of the factors as discussed above are subject to quantitative measurements while for other factors, it is necessary to rely entirely upon a qualitative and somewhat subjective appraisal.

IV. ANALYSIS OF REAL GROWTH OF THE ELECTRONICS INDUSTRY

The discussion presented in the Section II shows that electronics industry has grown at a compound rate of 16.7 per cent during the period 1975-80. Electronics is one of the industries in India where though the prices of basic raw materials have increased considerably, the prices of individual end products have not registered an increase proportionate to increase in consumer as well as other engineering products. For example, prices of most of the components, basic metals have gone up but the prices of radio receivers, television receivers and instruments which account for sizeable proportion of the total electronics production in India, have not registered an increase proportionate to general inflation. However, it is observed that for a number of items growth figure in terms of physical numbers is much lower than the growth in monetary terms. The concept of inflation can be ignored if one can express the growth of entire industry in terms of physical output of individual items. It will, however, be difficult for the electronics industry as a whole, which comprises a wide variety of products with wide variation in specifications and designs. Therefore, to arrive at the growth in real terms, the growth seen in purely monetary terms at current prices would have to be appropriately reduced by the extent of inflation. Since no price index is available for the electronics industry, the production of various items at the current prices have been

normalised with respect to a unit price level of 1975, which is taken as the base year for comparison. The methods followed for normalisation for different sectors of electronics industry are briefly described in the following:

Methodology

1) Components: The production of components at current prices has been normalised in general with respect to average unit prices of components prevailing in 1975. However, in the years, when there is a fall in prices of components, as is the case with TV picture tube and semiconductor devices, the actual production is taken to be the production in real terms.

2) Consumer Electronics: The production of consumer electronics items except TV receivers has been normalised with respect to average unit price prevailing in 1975. The prices of TV receivers, as a result of reduction in import and excise duty in 1976 and 1977 were reduced by about 25 per cent. Therefore to have a meaningful comparison, the production of TV receivers for years 1975 and 1976 has been normalised at price level of 1975 and normalisation of production for the years 1977, 1978, 1979 and 1980 is done at 1977 price level. The miscellaneous items which include electronic watches, hearing aids, electronic toys, etc., have registered fall in prices during last 5-6 years. The actual production for these items is taken to be the production in real terms.

3) Telecommunication and Communication Equipment: The production of a few major items of telecommunication sector like teleprinters, telephones, cross bar system, strowger systems, etc., is normalised at 1975 price level. Since the telecommunication sector mainly comprises these items, the index of inflation so derived is applied to normalise the production of telecommunication and communication equipment.

4) Aerospace and Defence Equipment: In order to estimate the growth in production in real term in aerospace and defence sector, the production has been normalised by the inflation index as derived for telecommunication equipment sector. The reasons for such estimation are given in this dissertation.

5) CIIE Sector: This sector covers a wide cariety of instruments and instrumentation system which are based on different principles. Unlike consumer electronics, components and other industries, the precise data of production of different items both in terms of numbers and value is not available. Nevertheless, with a view to find out the variation in the prices of instruments during the last six years, prices of number of instruments manufactured by ECII, Unitron, BPL, etc. for the years 1975 and 1980 are obtained. The estimation of production in real terms in CIIE sector is computed by applying the inflation index obtained from the average change in prices of these instruments to the total CIIE production at current prices.

6) Computers and Calculators: Like CIIE sector, the prices of

some computer models prevailing in 1975 and 1980 are obtained. The total production at current prices is then normalised/modulated with respect to variation in prices between 1975-1980. However, for calculators since the prices have registered a continuous fall since 1975, the actual production is taken to be production in real terms.

The results of analysis for different sectors of electronics industry are described and discussed in the following sections.

ANALYSIS:

a) Components: The discussion presented in Section II indicates that the components industry has grown at a compound rate of 16.8 per cent at current prices during the years 1975-1980. Table 5 gives growth rates for the production of selected components in the organised sector during 1975-80. It is observed from the Table that for majority of items growth figures in terms of physical numbers have been much lower than the growth rates in terms of value. The large difference in the growth rates of production for physical numbers and values is due to the significant price increase that has taken place during these years. Change in the average unit prices of some selected components during the period 1975-80 (based on the organised sector production) is given in Table 13. The range of this change is different for different categories of components.

Using the methodology described earlier Table 14 summarises the growth of electronic components production during 1975-80 at current prices at a constant price level of 1975, for four broad

Table No. 13: Change in average unit prices of some selected components during the period 1975 to 1980 (Value in Rs.).

Sl. No.	Item.	1975	1980	Percentage price increase over the period 1975-80.
1.	Receiving tubes	7.26	13.72	89
2.	Transmitting tubes	2.090	1.963	-6
3.	TV picture tubes	553	403	-37
4.	Transistors and diodes	2.19	2.08	-5
5.	Carbon film resistors	0.092	0.116	26
6.	Metal film resistors	1.91	2.59	36
7.	Plastic film capacitors	0.47	0.96	104
8.	Alelectrolytic capacitors	1.29	2.13	65
9.	Tatalum capacitors	13.88	14.39	4
10.	Ceramic capacitors	0.21	0.28	33
11.	Gang condensers	5.40	9.58	77
12.	Loudspeakers	11.58	16.71	44
13.	Soft ferrites/kg	44.75	69.14	54
14.	Hard ferrites/kg	27.14	26.35	-3
15.	Permanent magnets/kg	27.14	26.35	217
16.	Connectors	25.60	54.24	112
17.	Switches	7.9	21.10	171

Table 14: Growth of electronic components production during 1975-80 at the current prices and at a constant price level of 1975 (value in Rs. million).

Sl. No.	Component category	1975	1976	1977	1978	1979	1980	Compound growth rate (%)
1.	Electron tubes							
	Current prices	98	86	104	130	153	186	13.7
	1975 prices	98	80	95	115	137	161	10.5
2.	Semiconductor devices							
	Current prices	159	135	163	192	235	292	12.9
	1975 prices	159	135	163	192	235	292	12.9
3.	Passive components (resistors, capacitors crytals, permanent, magnats, loudspeakers, and ferrites)							
	Current prices	200	258	307	375	426	523	21.0
	1975 prices	200	254	302	300	292	321	10.0
4.	Electromechnical & other components including TV deflection components, TV tuners and tape decks)							
	Current prices	293	321	331	473	546	629	16.5
	1975 prices	293	311	303	411	486	496	11.1
Total	Current prices	750	800	905	1170	1360	1630	16.8
	1975 prices	750	780	863	1018	1150	1270	11.1

categories of components. Fromtthis data it is evident that the components production in India has increased from Rs. 750 million in 1975 to Rs. 1270 million in 1980 (Rs. 1630 million at current prices) which shows a compound growth of 11.1 per cent only compared to a growth rate of 16.8 per cent at current prices. Based on the total components production given in Table 14 the year wise real and apparent growth in the production of components during 1975 to 1980 has been determined and is given in Table 15. The real growth in the production of components has not been uniform. The maximum growth rate was during 1977-1978. On the

Table 15. Real and apparent annual growth in the production of components.

Sl. No.	Year	Percentage growth	
		Apparent (at current prices)	Real (at 1975 prices)
1.	1975-1976	6.7	4.0
2.	1976-1977	13.1	10.7
3.	1977 -1978	29.3	18.0
4.	1978 - 1979	16.2	13.0
5.	1979 - 1980	19.9	10.5

whole it may be seen that 5.7 percent of the growth in the component sector has been due to price increase. The data also indicates that major increase in prices was during 1977-78 and 1979-80

With a view to have an idea of the real growth in the components sector since 1975, each category of components has been discussed separately.

Electron tubes: The major share of production in this category is for TV picture tubes. It's price was about Rs. 560 in 1975, but with the reduction of import duty on glass shell in 1976, its price was reduced to 465 in the first instance. The price further came down to Rs. 405 in 1977 and is almost stable thereafter. In addition to this the prices of transmitting tubes and cathode ray tubes have also decreased marginally. But this may be attributed to the change in product mix. Because of the fall in prices the actual year-wise production for these three types of tubes has been taken to be the real production. The prices of receiving tubes have increased the highest followed by X-ray tubes and microwave tubes.

Onaanalysing the production of electron tubes at 1975 prices, it is found that its production has increased from Rs.98 million in 1975 to Rs. 161 million in 1980 as compared to a production of Rs. 186 million at current prices. The compound growth rate was 13.7 per cent at current prices and 10.5 per cent at 1975 price level. This shows that the impact of inflation on the total electron tube production growth rate is slightly more than 3 per cent.

Semiconductor devices: The area of semiconductor devices, in generl, has shown relative price stability and in some cases the prices have, infact decreased. This trend may be due to increase in the level of production and/or more yield. Around 1975, the manufacturing activity for some of the semiconductor devices like integrated circuits and power devices was in the initial stages

and the prices were high. With the passage of time, not only the prices have come down, but the devices with better characteristics and new types were produced. The actual increase in production in this sub sector is due to the increase in the real production. The production of display devices like LEDs and LCDs started during this period, though its production is very small yet. It must be noted that though the prices of semiconductor devices have fallen in India over the years but still these are higher than the international prices.

Passive components: The prices of all the passive components except hard ferrites have increased during the period 1975-80. The maximum increase in prices was in the case of permanent magnets (About 220 per cent). This is due to the steep rise in the prices of cobalt and nickel in the international market, which is imported by the indigenous industry for the manufacture of cast alloy permanent magnets. Similarly increase in the prices of aluminium foil and plastic film have effected considerably the prices of aluminium and plastic film capacitors. It is also observed that increase in the prices of passive components manufactured by organised sector units is much more than the increase in the case of small scale manufactured components. In organised sector there are few units making passive components and major increase is due to the increase in the prices of their components.

The production of passive components has increased from Rs. 200 million in 1975 to Rs. 322 million in 1980 at 1975 prices

Table 16. Growth in consumer electronics production during 1975-80 at current prices and at a constant price level of 1975. (Value in Rs. million).

Sl. No.	Item	1975	1976	1977	1978	1979	1980	Compound growth rate (%)
1.	Radio receiver							
	Current prices	410	479	530	737	827	965	18.2
	1975 prices	510	474	611	719	835	945	18.1
2.	Television receiver							
	Current prices	210	315	460	523	611	725	28.0
	1975 prices	210	309	517	584	673	798	31.0
3.	Tape recorder							
	Current price	35	37	65	99	107	168	37.0
	1975 prices	335	39	79	105	125	211	43.0
4.	Record player							
	Current prices	45	49	60	67	73	83	14.1
	1975 prices	45	39	42	43	50	46	0.4
5.	PA system							
	Current prices	75	99	101	112	112	136	15.9
	1975 prices	70	78	81	82	85	87	4.4
6.	Miscellaneous	50	31	54	37	55	63	4.8
Total	Current prices	820	1010	1290	1575	1790	2140	21.1
	1975 prices	820	970	1384	1570	1823	21.2	21.1

representing a compound growth of 10 per cent. As compared to this, the production at current prices was Rs. 523 million. The year wise analysis of the production of passive components at 1975 prices shows that the production has not increased much since 1977 and the major increase is due to inflation only.

Electromechanical and other components: The production of this category of components has increased from Rs. 293 million in 1975 to Rs. 496 million in 1980 at 1975 prices with a compound growth rate of 11.1 per cent. The major part of this production is from small scale units. The prices of majority of electromechanical components has gone up significantly since 1975 due to increase in prices of basic raw material used for manufacturing these components, but for some items, prices have fallen for example the prices of TV tuner decreased from Rs. 150 in 1975 to Rs. 100 in 1980.

b) Consumer Electronics: An item wise data relating to the growth of consumer electronics industry at current prices and at a price level of 1975 is given in Table 16. Except for the year 1976, the inflation has not played any dominant role and the actual increase in production is in real terms. There are some qualitative aspects of growth in consumer electronics. For example, a large share of growth is accounted by the radio and TV receivers. The volume of production of these two items, in real terms averaged 80 per cent of total real production of consumer electronics. In all the consumer electronics items except record player and PA system, either the prices have been

reduced or there is a relative price stability. On the other hand, not only there has been appreciable price increase in record players and PA systems during the last six years but product mix has also changed. Stereo players and amplifier systems with unit prices much higher than the conventional record player and PA systems have been introduced in the market. Therefore, to arrive at a meaningful real growth in production of record players and PA systems, price variation in the individual products has to be taken into account and the estimated growth rate of 0.4 and 4.4 per cent respectively have to be modulated suitably. However, since the share of production of record players and PA systems in the total consumer electronics is below 10 per cent, the effect of such modulation on the total consumer electronics production is eexpected to be marginal.

The yearwise real and apparent growth rates of production of eonsumer electronics are given in Table 17. The maximum growth in real terms has been observed in 1976-77. This is largely

Table 17. Real and apparent annual growth in consumer electronics production.

Sl. No.	Year	Percentage growth	
		Apparent (at current prices)	Real (at 1975 prices)
1.	1975-1976	23.0	20.5
2.	1976-1977	21.0	39.6
3.	1977-1978	22.0	13.4
4.	1978-1979	13.6	16.1
5.	1979 -1980	19.5	17.9

due to the fact that there is a considerable fall in the prices of TV receivers as a result of cut in excise and import duties.

Analysis of cost structure: The production in this sector is basically assembly oriented and requires low capital investment. The assembly cost, (because of simple technology) and the direct manufacturing expenses are low. However, for most of the consumer electronics items, components cost form a substantial part of end product cost. The variation in the price of consumer electronics products to a large extent depend on the variation in price of components. The cost studies of some of the consumer electronics items have been carried and are described below:

i) Radio Receivers

a) Raw material and components: Based on the informations gathered from the industry, the price structure of a low-cost ratio receiver which sells under Rs. 250 can be broadly given as follows.

(i)	cost of components	60% of exfactory value
(ii)	Labour cost	5%
(iii)	Cabinet, packing and forwarding	12%
(iv)	publicity and other overhead charges	13%
(v)	Profit	10%

For the above, it is seen that in a radio receiver, on an average, components account for about 60 percent of the ex-factory value of a set. This figure will be different for the sets produced in the organised sectors where due to large overheads the ex-factory cost itself is high as compared to those in small scale sector. It has been observed that cost of a radio set on an average has increased by about 10 to 15 per cent during

the last few years, the major reason being, the increase in the cost of components. Almost all sorts of components barring active devices required for assembly of radio receiver are produced in the small scale sector. The increase in the prices of components produced in the small scale sector has been less compred to the components produced in the organised sector.

The change in circuitry design in 1974-75 from germanium devices to silicon devices reduced the bill of components. Some of the components like antenna and some transformers used earlier and where prices were increasing rapidly were dispensed with. The prices of silicon devices going into the radio receiver have decreased during the last 5-6 years. A variation in prices of some of components required for radio receiver is given in Table 18. Infact a kit for three band is now readily available for Rs. 70 to Rs. 80.

Table 18. Trend in prices of some of components used in low cost radio receiver (Price in Rs.)

Sl. No.	Item	Prices in		Percentage change
		1975	1980	
1.	IFT (set)	2.70	3.25	20
2.	Resistance (fixed)	0.07	0.08	14
3.	Coil set	2.50	2.00	-20
4.	Ferrite core	1.40	1.60	14
5.	Active devices	16.00	14.00	-12
6.	Loudspeaker	6.00	7.00	17
7.	Capacitors (fixed)	0.60	0.80	33
8.	Band change	1.75	2.10	20
9.	Variable gang condenser	2.00	2.50	25

b) Wage and other overhead expenses: The production of radio receivers is more or less assembly based and technology involved is of simple nature. The investment on equipment is low. All the components are indigeneously produced. Thus the effect of various factors like increase in transportation cost, increase in rates of interest, etc., have contributed marginally to the order of 2 to 3 per cent to the overall increase in the cost of radio receivers. However, the effect of increase in wages and salaries on the cost of radio receiver will vary from organised sector to small sector. Since the direct manufacturing cost due to wages and salaries is small in case of radio sets from small scale sector, increase in wages will have marginal effect on the cost of radio sets. However, the effect of increase in wages and salaries and overhead costs has been appreciable to the order of 30-40 per cent for radio sets produced in the organised sector. Consequently it has been observed that the cost of radio receivers produced in the organised sector has increased by about 15to 20 per cent during the last few years.

ii) Television Receiver:

a) Raw material and components: The cost break up of exfactory price of 51 cm single channel TV set for the year 1975 and 1980 is given in Table 19. On an average, the components account for about 35 per cent, TV picture tube 27 per cent and cabinet 11 per cent of the exfactory value. The rest of the 29 per cent is distributed among over-head charges like wages and salaries, marketing cost, electricity, etc. The components along with

picture tube accounts for about 62 per cent of the exfactory value. The cost of TV set thus varies to a large extent with the variation in the cost of components. Escalation in price of picture tube was one of the major reasons which contributed to higher cost of TV sets in 1975, the price being the highest in that year. Thereafter the price of picture tube declined

Table 19. Cost break-up of typical 51 cm single channel TV set (value in Rs).

S.No.	Item	Price* 1975	Price** 1980
1.	Components	730	770
2.	Picture tube	610	450
3.	Cabinet	250	250
4.	Wage/labour	55	55
5.	Electricity	5	5
6.	Interest & other miscellaneous expenditure	205	100
7.	Marketing cost	210	60
8.	Profit	185	60
	Ex-factory value	2250	1750

* Cost break-up of a hybrid model TV set

** Cost break-up of a transistorised set

by about 17 per cent. The variation in price of picture tube is shown in Table 20. The decrease in price reduced the production

in terms of value where as in terms of number, the growth was more. However, in 1976, as a result of reduction in import duty on glass shells by about 111 per cent and introduction of differential excise duty in 1977, the prices of picture tube and TV receivers were further reduced by about 34 per cent and 30 per cent respectively.

A hike in the components price has been registered during 1975-1980. Components like resistors, condensers, showed an average price increase of about 30 to 50 per cent over their value in 1975 (Table 13). At the same time, the prices of semiconducting devices, and some specialised components have declined since 1975. For example, the orice of TV tuner decreased from Rs.150 in 1975 to Rs.100 in 1980, showing a decrease of 33 per cent. Similarly the prices of deflection components and picture tube registered decrease by 21 per cent and 20 per cent respectively. The overall increase in the components cost (excluding TV oicture tube), as indicated by TV manufactures has been to the order of Rs. 40-50 which works out to be about 8 per cent of the cost of components used in 1975.

Table 20. Trend in price of picture tube (price in Rs).

Picture tube	Year					
	1975	1976	1977	1978	1979	1980
51 cm	565	465	405	405	405	395

b) Wages and other manufacturing expenses: Most of the production of TV receivers is in the small scale sector, where wages and salaries have not increased significantly as compared to those in organised sector. The direct manufacturing cost due to wages and salaries amounts to only 3 per cent of the ex-factory cost. Wages and salaries of industrial workers have varied by 40-50 per cent during the last six years. This has affected the direct manufacturing only to the extent of 4 to 5 per cent. The rising prices of cabinets are being minimised by using simple cabinets. The increase in the overhead charges like interest rates, transportation costs and other administrative expenses have been compensated by the productivity gain. As a result, the price stability in TV receivers has been maintained.

iii) Tape Recorders: The tape deck mechanism is the most important single element that controls the cost of tape recorders and two in one systems. It accounts for more than 50 per cent of the total cost of components in a tape recorder.

In the initial years of period 1975-1980, the production was based on import of components like tape deck mechanism,

Table 21. Cost breakup of a typical, low cost cassette tape recorder

S.No.	Item	Price	
		1975	1980*
1.	PCB with all parts	85	65
2.	Tape deck mechanism	230	165
3.	Recording and erasing head, condenser microphone, electrical-mechanical parts including cabinet, loud-speaker, wire etc.	135	100
4.	Labour and overhead charges	50	65
	Total	500	395

*Representative figures.

Table 22. Growth in production of telecommunication equipment items at current prices and at constant price of 1975 (value in Rs. million)

Sl. No.	Item	Years						Compound growth rates (%)
		1975	1976	1977	1978	1979	1980	
1.	Teleprinter							
	Current prices	31	43	36	48	44	61	14.5
	1975 prices	31	40	33	45	39	51	10.6
2.	Telephone							
	Current prices	75	125	146	117	148	142	13.6
	1975 prices	75	87	87	80	89	94	4.6
3.	Strowger exchange							
	Current prices	219	185	246	261	255	376	11.4
	1975 prices	219	216	234	250	219	224	0.5
4.	Cross bar exchange							
	Current prices	160	161	184	185	179	225	7.1
	1975 prices	160	133	157	140	141	136	(-)3.5
5.	Electronics exchange							
	Current prices			2	2	4	9	65
	1975 prices			2	1.2	1.3	6	45
Total	Current price	485	514	614	613	630	813	13.5
	1975 price	485	476	513	516	488	511	1.1

Table 23. Growth in production of telecommunication and communication equipment industry at current prices and at price level of 1975 (value in Rs. million)

Price level	1975	1976	1977	1978	1979	1980	Compound growth rate (%)
At current prices	995	1120	1275	1275	1285	1845	13.1
At 1975 prices	995	1037	1065	1070	995	1160	3.9

micromotor, some time cabinets also. As a result the cost of tape recorders were quite high ranging around Rs.1,200 aporoximately three/four times the cif value of imported sets. However, now the import is limited to basic components like magnetic heads, microphone condenser and micromotors, and tape deck mechanism is being produced locally. As a result of indigenisation, the prices of tape-decks have fallen by about 25 per cent thereby bringing down the ex-factory cost of tape recorders. The tape recorder manufacturer now needs import of around Rs.75 for each cassette tape recorder. The major portion of production of tape recorders is of cassette recorder where technology involved is simple. The labour charges and cost of production is small. The cost break-up of cassette tape recorder is given in Table 21.

3) Telecommunication and Communication Equipment: A study of Table 7 indicates that for majority of items in this sector, growth rate in terms of physical numbers have been much lower than the growth rate in terms of value. Table 22 gives the growth in production for few major items of telecommunication sector like teleprinters, telephones, strowger, cross bar and electronic exchanges at current prices and at 1975 price level. It is evident from this Table that prices of these items have increased on an average by 40 per cent during the last six years. In real terms, increase in production of strowger exchange is marginal while for cross bar exchange growth rate is negative. The growth in production of telecommunication industry at the prevailing

prices and at a constant price level of 1975 is shown in Table 23.

As compared to the growth rate of 13.1 per cent in apparent term, the growth rate in real term is only 3.9 per cent. The yearwise trend in the real growth (Table 24) reveals that the production in real term has almost been stagnant during the period 1975 to 1980, though the production increased in apparent term. This suggests that increased production in this sector is mainly due to increase in prices. A view of the magnitude of inflation during 1975-80 in telecommunication industry is shown in Fig. 3.

Table 24. Annual growth rate of production in telecommunication and communication equipment.

S.No.	Year	Growth rate (%) at current price	Growth rate (%) at 1975 price
1.	1975-1976	12.5	4.2
2.	1976-1977	13.8	2.7
3.	1977-1978	0.0	0.4
4.	1978-1979	0.8	(-)8.0
5.	1979-1980	43.0	16.5

Analysis of Cost Structure:

a) Raw material and components: The rise in prices of different raw materials, increase in wages, transportation costs and administration expenses are the main factors which have contributed

to the price increase of telecommunication system. On an average, the cost break up of telecommunication industry in terms of value can be given as follows.

(i) Materials and components	40%
(ii) Wages and salaries	35%
(iii) Direct and other expenses	15%
(iv) Tax	1.5%
(v) Profit	8.5%

These figures may show slightly variation from unit to unit.

The telecommunication equipment comprises both mechanical parts and electronics system. A few years back, electromechanical systems dominated, where as trend is now in favour of electronic telecommunication systems. The rise in prices in raw materials for the two categories have been different. Increase in cost of mechanical parts has been noticed more as compared to electronics systems. It is estimated that the prices of faw materials going into the telecommunication equipment have increased by 60-75 per cent approximately. However, since no specific details as regard to share of electronics components and mechanical parts towards the overall bill of raw materials is known to estimate the exact increase in the cost of raw materials is a much more involved task.

b) Wages, salaries and manufacturing expenses: Besides raw material, labour and manufacturing expenses forms a substantial part of the cost of product. It is estimated that these two overheads together account about 50 per cent of the production cost. If wages and salaries bill increases at the same rate at which

Table 25. Growth in salary and wage bill and manufacturing expenses of ITI during 1975-79
(in Rs. million)

Sl. No.	Item	1975	1976	1977	1978	1979	Compound growth rate (%)
1.	Wages and salary						
	Current prices	233	248	315	358	375	12.6
	1975 level	233	251	266	275	285	5.2
2.	Manufacturing and other expenses						
	Current prices	81	106	118	95	126	11.7
	1975 level	81	87	92	96	99	5.2
3.	Number of employees	22040	23771	25153	26021	26799	
Total	Current prices	314	354	433	453	501	12.4
	1975 price level	314	338	358	371	384	5.2

Table 26. Growth in production of aerospace and defence equipment at current prices and at price level of 1975 (value in Rs. million).

Sl.No.	Price level	1975	1976	1977	1978	1979	1980	Compound growth rate (%)
1.	At current prices	490	500	550	620	605	680	6.8
2.	At 1975 prices	490	463	459	522	469	428	(-) 15

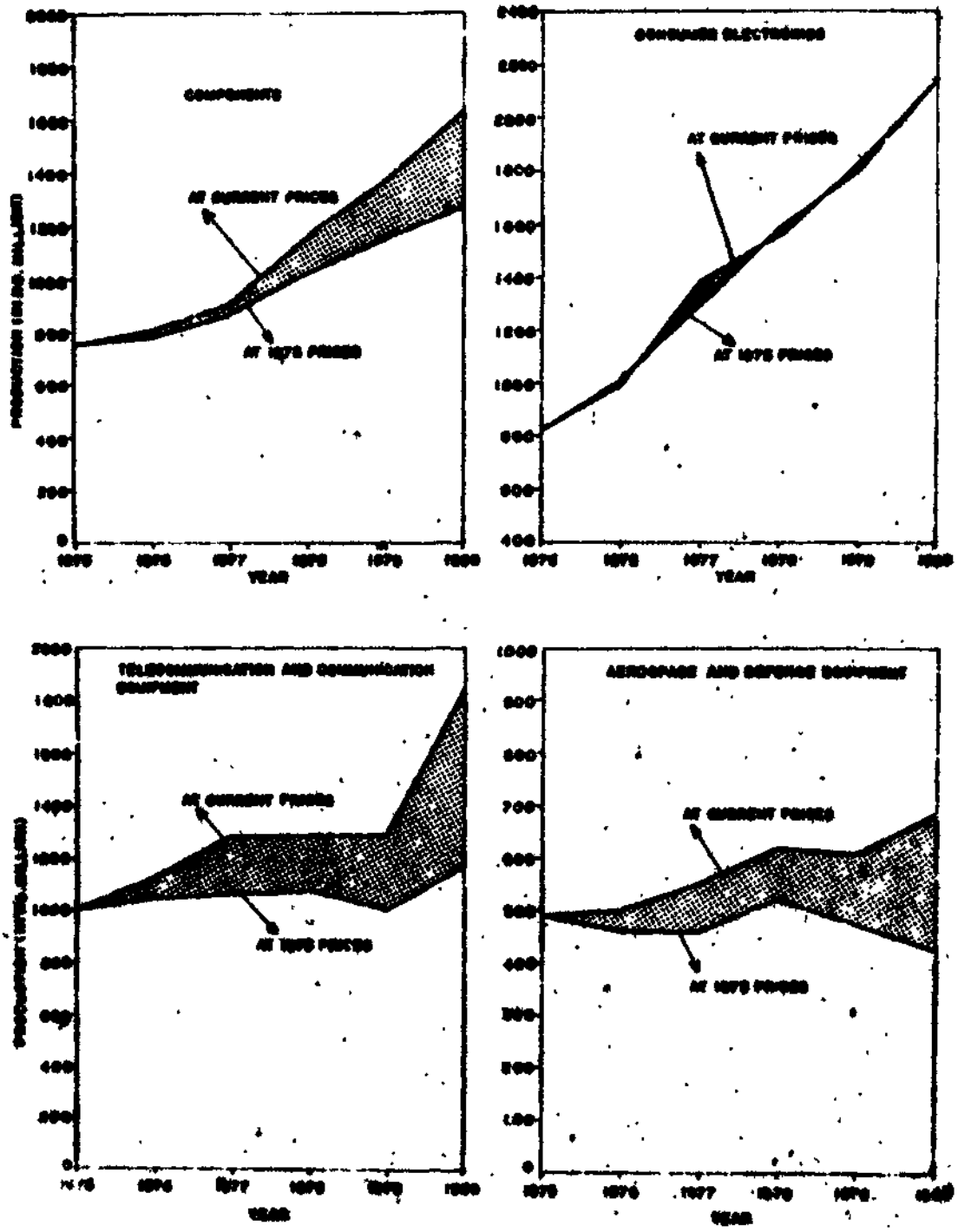
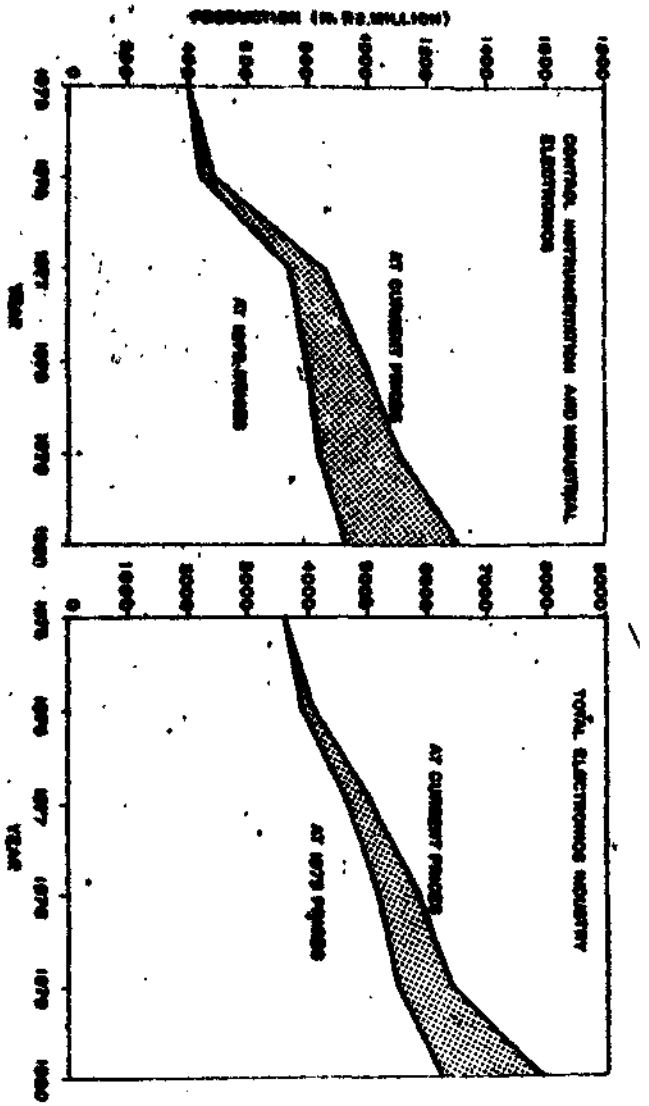


Fig 3 Growth in production of different sectors of electronics industry and total electronics industry at current prices and at 1975 prices


CONTROL INSTRUMENTATION AND INDUSTRIAL ELECTRONICS
AT CURRENT PRICES
AT 1972 PRICES
TOTAL ELECTRONICS INDUSTRY
AT CURRENT PRICES
AT 1972 PRICES

average will practically remain stable, but in case of ITI, rate of increase of wages and salaries bill is more than the rate of increase of productivity. The former has increased by about 60 per cent, the latter showed variation by 10 per cent between 1975-79. Similarly the rate of increase in wages and salaries bill is more than the rate of increase in number of employees. The growth in wages and salaries bill and manufacturing expenses at current prices and at constant price level of 1975 is given in Table 25. Between 1975-79 the manufacturing expenses witnessed a significant increase of 50 per cent and wages and salaries bill increased by about 61 per cent which increased the production cost by 10 per cent and 15 per cent respectively.

Since the entire production in telecommunication area is in the public sector units where wage structure and overhead expenses do not differ much from one another, the price variation in other units producing telecommunication equipment may be assumed to be of the same order as that of ITI.

4) Aerospace and Defence Equipment:

The approximate invariant percentage break up of cost of production for aerospace and defence equipment is approximately the same as for telecommunication equipment. The cost of production per employee is Rs. 14000 for BEL and Rs. 13240 for ITI. Therefore, to estimate the real growth in aerospace and defence sector, the production has been normalised by the same inflation index as for telecommunication sector. The results are presented in Table 27. The production in real terms has been fluctuating with a peak value of Rs. 522 million in 1978. Thereafter, it has decreased continuously

Table 27. Growth in wages and salary and bill and manufacturing expenses of BEL during 1975-79 (in Rs. million)

Sl. No.	Item	1975	1976	1977	1978	1979	Compound growth rate (%)
1.	Wages & salaries						
	Current prices	1653	1713	2080	2304	2421	10.0
	1975 prices	1653	1667	1722	1758	1820	2.5
2.	Manufacturing & other expenses						
	Current prices	689	884	904	941	1103	12.5
	1975 prices	689	695	718	733	759	2.5
3.	Number of employees	15642	15780	16298	16644	17229	
Total	Current price	2342	2597	2984	3245	3524	10.8
	1975 prices	2342	2362	2440	2491	2579	2.5

registering a lowest value of Rs. 428 million which is even below the 1975 production value. In real terms, the sector has registered a negative growth rate of 2.8 per cent between 1975-80. This reflects that increase in valuewise production in the sector is purely because of increase in prices.

Analysis of Cost structure: Like telecommunication industry, the increase in prices of raw material, wages and salaries bill, manufacturing expenses have contributed largely to the apparent growth.

a) Wages and Salaries: The yearsise increase in the wages and salaries bill and the manufacturing expenses of BEL, at current prices and at price level of 1975 is shown in Table 28. A study of this table reveals that in case of BEL, which is the principal producer of aerospace and defence equipment, the wages and salaries have increased at much faster rate than productivity. The former increased by 60 per cent, whereas the latter showed increase of only 28 per cent between 1975-80. It is apparent from the table that about 7.5 per cent and 10 per cent compound increase in the

Table 28. Growth in inventory of some public sector units.

Unit	Percentage ratio of production to inventory	
	1975	1979
BEL	82	93
ITI	170	107
HTL	220	176
IL	60	92
HAL	72	64

wage bill and manufacturing expenses are on account of inflation. It is estimated that these have individually caused the increase in cost of production of aerospace and defence equipment by about 15 per cent and 10 per cent, respectively.

The data shows that trend in increase in wage bill and manufacturing cost is of the same order of magnitude as in the case of telecommunication industry. It is clearly evident that the growth in production of telecommunication and aerospace and defence sectors are largely due to inflation. This is due to the fact that whereas in the consumer and component industries, the production is shared by small scale industry and organised sector, the entire production in telecommunication and aerospace and defence sector is in public sectors. The public sector industry is more capital intensive and the operating costs are high. Factors like large raw material consumption, double handling non-commercial and unprofitable line of activity, high expense ratio, high establishment cost, etc., accounts for high operating costs. All these factors reflects in the cost of end products.

b) Inventory: It is observed that most of the public sector units carry high inventory. A ratio of production to inventory for few public sector units for the period 1975-79 is given in Table 28. Except BEL and IL, the ratio has increased in between 12 to 35 per cent. Accumulation of stock of items, including raw materials has increased. Because of large lead time involved in procuring raw materials and uncertainty arising out of delays in obtaining clearance from the government agencies, the constraints are so

binding that units tend to overstock. This inventory accumulation blocks-up capital. Since finance to the public sectors units are available at considerable rate of interest (16-19 per cent), high inventory results in a considerable payment of interest which boosts up the cost of production thereby influencing the price structure of end system.

5) Control, Instrumentation and Industrial Electronics:

The increase in prices of variety of instruments in different areas of CIIE, between 1975 and 1980 as indicated by some manufacturing companies are summarised in Tables 29, 30, 31 and 32. The absolute increase in prices of categories of instruments have been different. The maximum rise in prices in the area of test and measuring instruments. This is followed by process control, nuclear and medical electronics equipment. The prices of instruments in general, increased on an average by 40 per cent during this period. The systems produced by other manufacturers have also shown similar variation in prices. Therefore, by normalising the total CIIE production, by the average change in prices of instruments, it is found that in real terms, the growth rate of production has been 18.5 per cent as compared to apparent growth rate of 26.8 per cent. The results are summarised in Table 33.

Analysis of Cost Structure: The main reasons for the price increase are, rise in cost of raw materials, components, manufacturing expenses, system design and engineering, installation costs, maintenance and service etc.

Table 29. Increase in prices of some nuclear instruments during 1975-80 manufactured by ECIL (value in Rs.)

Sl. No.	Item	Year		Percentage change
		1975	1980	
1.	Geiger counting system	20,940	27,920	33
2.	-do- B	7,416	10,300	38
3.	-do- C	3,500	4,700	35
4.	Proportional counting system	67,000	1,08,150	61
5.	Automatic liquid scintillation system	1,40,000	1,99,350	42
6.	Gamma ray spectrometer	24,700	30,220	47
7.	-do- B	15,000	24,200	60
8.	Alpha counting system	14,000	22,000	57
9.	Nuclear quadruple	7,500	11,900	58
10.	Electron spin resonance	1,34,000	2,02,000	50
11.	Fast slow coincidence system	1,30,000	1,78,250	37
12.	Medical scanner	1,05,000	1,67,250	59
13.	Renographer	91,000	1,39,750	54
14.	Medical spectrometer	45,000	66,350	47
15.	Radio isotope calibrator	22,000	34,000	54
16.	Radiation survey meter	3,000	4,400	46
17.	Gamma radiography survey meter	4,500	6,100	36
18.	Alpha monitor	42,000	49,900	19
19.	Count rate meter	4,000	4,940	24
20.	Preamplifier	1,800	2,640	47
	Average			45

a) Raw Material and Components: The production of almost all types of professional instruments in CIIE sector requires a number of high quality components which include both mechanical, electro-mechanical and electronics parts. The pattern of requirement varies considerably depending upon the products. However, it is estimated that on an average, the share of electronics components ranges between 20 to 40 per cent, the rest is of mechanical electro-mechanical parts. The prices of electronics components have increased on an average by 25 per cent between 1975-80 (Table 14). This has caused an increase in cost of production by about 10 to 15 per cent. On the other hand, the prices of mechanical and electromechanical parts have increased quite appreciably about 60 to 70 per cent during this period (Tables 8, 9 and 10), which, it is estimated, increased the cost of production by about 25 to 30 per cent. Overall, about 20 to 25 per cent increase in cost of production in CIIE is on account of increase in the cost of raw materials and components.

b) Wages and salaries and manufacturing expenses: The instrument manufacturing though mainly assembly oriented operation, but since these are in general used as tools in estimation and control of various parameters, therefore, these require extensive testing during the assembly and at the final stage. The labour and production development costs are high and forms substantial part of end system. In the case of manufacture of control equipment, precision machining facilities are required, Hence the investment on plant and machinery is high.

Table 30: Increase in prices of test and measuring instruments during 1975-1980 (value in Rs.)

Sl. No.	Item	1975	1980	Percentage change
1.	Digital pH meter	5000	5800	16
2.	Flurometer	17000	20000	18
3.	Mercury analyser	8,000	13000	62
4.	Gauss meter	2000	2600	30
5.	Oscilloscope (model A) 15 MHz	18000	23000	28
6.	Oscilloscope dual traced 50 MHz	35000	45000	30
7.	50 MHz oscilloscope dual trace	35000	49000	32
8.	100 MHz dual trace oscilloscope	45000	52500	17
	Average			29

Table 31: Increase in prices of some medical electronics equipment during 1975-80 (Value in Rs.).

Sl. No.	Item	1975	1980	Percentage change
1.	ECG monitor	26500	31000	17
2.	Cardiart	8000	10000	25
3.	Cardiograph	8000	11000	33
4.	Pace maker	3300	4000	21
5.	Bedside monitor	10000	13200	20
6.	DC defibrillator	12500	18000	40
	Average			27

Table 32: Increase in prices of test and measuring instruments (value in Rs.).

Sl. No.	Item	1975	1980	Percentage change
1.	Audio oscillator	1500	2400	60
2.	RC oscillator	2600	3600	38
3.	RF oscillatory	2500	3250	28
4.	Function generator	12500	15750	26
5.	Signal generator	1650	22500	40
6.	AF signal generator	2100	2900	38
7.	FM/AF signal generator	13200	18900	43
8.	RF signal generator	1900	2950	52
9.	VHF equipment	1400	2450	71
10.	VTVM	2000	2500	25
11.	Oscilloscope (model A)	9950	13700	37
12.	-do - (model B)	1990	2750	37
13.	- do - (model C)	3500	4950	40
14.	Frequency divider	8000	11000	37
15.	Frequency counter	3000	4000	33
16.	Decades capacitance box	2000	2150	8
18.	Decades inductor box	1550	2450	58
19.	Modulator meter	21550	26700	23
20.	Stroboscope model	1950	2900	52
21.	LCR bridge type A	1350	19500	44
22.	LCR bridge type B	2678	4500	68
	Average			40

Table 33: Growth in production of CIIE computer sectors at the current prices at 1975 price level (value in Rs.)

Sl. No.	Sector	Production						Compound growth rate (%)
		1975	1976	1977	1978	1979	1980	
1.	Control instrumentation and industrial electronics							
	Current prices	400	475	855	989	1099	1306	26.8
	1975 prices	400	440	737	798	833	933	18.5
2.	Computers and calculators							
	Current prices	185	165	170	201	211	294	9.7
	Price 1975	185	161	164	188	194	264	7.5

A major share of production (about 75 per cent) in CIE sector is from the organised sector, where the labour costs and other manufacturing expsnes have risen more rapidly than those in the small scale sector. Table 34 shows the rise in wage bill and manufacturing expenses of Instrumentation Limited and ECIL, which

Table 34. Growth in wages and salaries and manufacturing expenses of instrumentation Ltd., and ECIL between 1975-1980 (figure in Rs. million)

Unit	Item	Year		Growth rate (%)
		1975	1980	
WAGES AND SALARIES				
IL	At current prices	26.6	52.8	14.7
	At 1975 price level	26.6	40.4	8.7
ECIL	At current prices	52.4	76.5	7.9
	At 1975 price level	52.4	60.8	3.1
MANUFACTURING EXPENSES				
IL	At current prices	14.5	62.7	3.4
	At 1975 price level	14.5	22.0	8.7
ECIL	At current prices	49.0	74.6	8.8
	At 1975 price level	40.0	56.9	3.1

are the principal producer of instruments, over the last 6 years. The data normalised at the prices of 1975 are also given in the same table. It is estimated that wages and manufacturing expenses increased by 30 to 35 per cent between 1975-80. These have increased the cost of production by about 15 to 20 per cent. However, these figures in case of small scale units will be slightly lower.

c) Qualitative aspect of growth: If one analyses the growth qualitatively, it is observed that CIIE sector has grown to such an extent that today there is hardly any industry where indigenous equipment does not find application in one form or the other. Therefore, merely looking at the production statistics will not give a clear picture of the growth of the CIIE sector. One must look into the technological capabilities and expertise that has been generated during the last six years, which will have larger impact on the future growth of this vital sector in the electronics industry.

In the initial years of industrial development in India, industrial plants were imported for package units of which control systems formed an integral part. Test and measuring instruments were imported under the different foreign aid sponsored schemes. With the growth of industralization in India in the last decade, the instrumentation, control and industrial electronics got a powerful thrust. The phenomenal growth of CIIE sector both in terms of value of production as well as production pattern is significant and is unique in the entire electronics sector. In a short span of time, India has achieved considerable self-reliance in the field. The phenomenal growth has been marked by two distinct features. The first has been the rate at which new products and techniques are being introduced and the second is improvement in manufacturing technology. As far as essential technological services, system engineering installation and commissioning are concerned, India has the necessary expertise right from conception to execution even for large projects. A few years backs there were limited number of units manufacturing/assembling instruments and control

systems. Today, there are several units like, instrumentation Limited, Taylor Instruments, Besto Bell, Keltron, ECIL, Dynacraft Tullman. Mahindra & Mahindra etc., in the field. BHEL and Instrumentation Ltd., which were handling a project of few million rupees a few years back are now having handling capabilities and capacity worth of Rs. 2500 million and Rs. 50 to Rs. 100 million, respectively. Keltron, which just entered in the field of instrumentation, has orders worth Rs. 250-300 million.

Most of the servo components required for defence and other applications which were imported from various countries are being made indigenously now and requisite skill for design and development of servo components exists in India. Today, most of the moderanisation programmes involving replacement of mercury are rectifier by solidstate power electronic equipment are being taken care of by local manufacturers. Uninterrupted power supplies of the order of tens of kVA, convertors of thousands of kW rating and invertors for hundreds of kW are being manufactured indigenously and have been commisioned in steel mills, petrochemical industry, textile mill, paper mills, etc. Solidstate logic system has been integrated in the cement plant in place of traditional relay logic system. Microprocessor based data loggers and annunciators are now commercially available. Indigenously manufactured electronic weighfeaders are being used in the Kundremukh project.

6) Computers and Calculators:

The variation trend in prices of constituents of this sectors, namely, computers and calculators are quite different from each other, Like other sectors of electronics, e.g., consumer, components, telecommunication industry, there can not be a uniform

invariant by which the production of this sector could be normalised largely for the purpose of estimating the production in real term. Therefore, in the following price variation has been analysed separately for calculators and computers.

a) Calculators: The cost of a calculator with 4 basis operation and printer type desk calculator with limited operation which used to be Rs. 350-400 and Rs. 3000-35000, respectively, in the year 1974 has decreased continuously during the last 5 to 6 years. The product range has increased and currently the pocket type calculators and desk calculators are available in the market in the range of Rs. 200-250 and Rs. 2000-2200 respectively. The actual value-wise production of calculatdrs thus can be safely assumed to be the production in real term.

b) Computers: The trend in price variation of computer systems have been different. The prices of some small computers have declined where as for majority of systems like TDC-316, TDC-312, HCL, etc., the prices have increased. For example, a typical 8 bit computer system which was costing approximately Rs. 0.25 million in 1975 now costs Rs. 0.30 million approximately, a increase in the prices by about 20 per cent. The similar variations has been observed in prices of computers from ECIL and other manufacturing units. If one normalises the production of computers in 1980 by 20 per cent and assume the actual production in calculators to be the real production, it is found that in real terms, the production of computer industry has grown from Rs. 185 million in 1975 to Rs. 264 million in 1980 recording a growth of 7.5 per cent. For the purpose

of estimating the year wise production in real terms during the last six years, the observed 20 per cent increase in the prices of computers has been splitted equally over the years 1975-1980 and the production is normalised/modulated accordingly. The results are summarised in Table 33.

c) Analysis of Cost Structure:

Calculators: The cost break up of a 4 operationpocket calculator and desk type calculator with printer is given in table 35. The main factors that have lead to decrease in prices of calculators are decrease in price of LSI, reduction of administrative expenses on account of large production and general competition in the market.

In calculators, the bill of components and material on an average accounts for about 70 per cent of the ex-factory value. The rest 30 percent is distributed among overhead charges like cost of labour, marketing cost, profits, etc. Components like LSI and display unit which form main part of the calculators, are being imported. While the cost of LSI and display accounts on an average 66 per cent of ex-factory value in a 4 operation calculator, its share reduces to only 13 per cent in a printer type desk calculators. The major share towards the overall cost in such calculators is accounted by the printer unit which is also being imported. The active and passive components like semiconductor devices, resistors and capacitors form on an average 5 per cent of the ex-factory value. The labour cost accounts only 3 to 5 per cent of ex-factory value depending upon the type of calculator. The prices of components

Table 35. Cost breakup of hand held and desk type calculators.

Item	Value* in Rs.
A. Four Operation Hand Held Calculator	
(i) LSI display tube	100
(ii) Cabinet	20
(iii) Resistance and condenser	6
(iv) Labour and manufacturing cost	9
(v) Profit	15
Total	150
B. Printer Type Desk Calculator	
(i) Printer unit	567
(ii) Cabinet	90
(iii) LSI	150
(iv) Display unit	70
(v) Active components	112
(vi) Passive components	60
(vii) Key board and other mechanical parts	227
(viii) Labour and other manufacturing exp.	50
(ix) Profit	300
Total	1626

*Ex-factory cost.

(excluding LSI) and wages, and salaries bill has increased during the past few years, but since these account only a small share of ex-factory value, the increase in their value is expected to have only marginal effect to the order of 5 per cent towards the overall cost of finished products. However, at the same time, prices of LSI have been decreased by about 20 per cent during the last few years. In addition to this, the manufacturers, due to increased production, marginal market competiton and large consumption have considerably reduced their profits. As a result, continuously, the sizeable reduction has been registered in the prices of calculators during the last 5 to 6 years.

Computers: The broad factors that go into the costing of a computer are as follows:

(i) Cost of CPU and memory

(ii) Cost of peripherals

(iii) Cost of labour

(iv) other miscellaneous costs such as for wiring, mounting hardware, control panel, final test and associated overheads.

The estimated approximate invariant percentage break up of a cost of production is given as

(i)	Raw materials and components	: 35%
(ii)	Labour	: 40%
(iii)	Miscellaneous	: 25%

a) Raw material and components: The minim and microcomputers produced in India involve the import of components such as LSIs, peripherals etc. The variation in their prices are reflected in the cost of computers. Besides this, import duty on components

increased considerably which has greatly influenced the end price of computers. The earlier computers (around 1975) manufactured by ECIL consisted of core memory, discrete components and second generation technology. With the core memory, the cost of the system even with small memory was higher due to the high cost of support circuit. As a result, the prices of computers were quite high initially. However, with development of semiconducting technology, memory and microprocessors, the cost of systems became primarily dependent on cost of chips and not on support circuit. The rate of technological progress is such that prices of LSI's have been reducing at fast rate and cost is still showing a downward trend.

However, the major cost of computer is towards the cost of peripherals. It is estimated that on an average the cost ratio of a computer to its peripheral units is approximately 40-60 per cent. The peripheral which are being imported on yearly contractual basis have registered increase in prices by about 35 per cent over the last 3 to 4 years. The reasons have been, increase in import duty as well as increase in prices. The price variation of some of the peripherals is shown in Table 36. While the trend in the initial years for the use of peripherals which were electromechanical in nature, recent trend in minicomputer field indicate the use of cheap and simpler electronic peripherals. The conventional peripherals like line printer, magnetic tape drives the disc drives which are costly have been substituted by low cost peripherals like dot matrix, non impact printers, digital cassette, cartridge drives and floppy disc drives. These peripherals are best suited, speedwise as well

Table 36: Trend in the price variation of some of the peripherals during the last five years

Sl. No.	Type	Price in* 1974-75	Price in* 1979-80
1.	Magnetic card readers	2250	2520
2.	Digital printer	7000	12400
3.	Flopping disketters	300	382
4.	Tele typewriter	10000	15000
5.	Paper tape reader	10000	16000
6.	Card reader (600 cpm)	45000	53400
7.	Magnetic tape unit	80900	91200

*Representative prices.

as cost wise to mini and microcomputers produced in India.

b) Wages and manufacturing expenses: In addition to rise in cost of raw materials, the other factor which has influenced the cost of end system is factor which has influenced the cost of end system is the increased wages and salaries bill. The major production of computers is in the private sector where the wages and salary is not very much linked with price index. Nevertheless, the wages and salaries of these units have increased by 30-40 per cent during the last five or six years. On the other hand, due to rapid expansion of computers market, increased production, the manufacturing cost has declined and productivity has increased by 40 to 50 per cent during the same period. Coupled with this is general improvement in technology and software. These factors have to some extent minimised the increase in prices of end systems.

Aggregate Electronics Industry:

The production figures of different sectors of electronics industry at current prices and at a constant price levels for the period 1975 to 1980 are summarised in Table 37. It is estimated that in monetary terms, about 5.4 per cent growth (compound) per annum in the electronics production is attributable to inflation. The yearwise production of different sectors of electronics industry and total electronics industry at current prices and at a constant price level of 1975 is shown in Fig. 3. The figure indicates that the production of electronics industry in real term has increased continuously from 1975 to 1980 but not in the same proportion as at current prices. The difference between apparent production and production in real term grew with the period, as shown in the

Table 37: Growth in production of different sectors of electronics industry at the current prices and at 1975 price level (value in Rs.).

Sl. No.	Sector	Production						Compound growth rate (%)
		1975	1976	1977	1978	1979	1980	
1.	Components							
	Current prices	750	800	905	1170	1360	1630	16.8
	Prices at 1975	750	780	863	1018	1150	1270	11.1
2.	Consumer electronics							
	Current prices	820	1010	1290	1575	1790	2140	21.1
	1975 prices	820	990	1384	1470	1823	2150	21.2
3.	Telecommunication & Communication							
	Current prices	995	1120	1275	1275	1285	1845	13.1
	1974 prices	995	1037	1065	1070	995	1160	3.9
4.	Control instrumentation & Industrial							
	Current prices	400	475	855	989	1099	1306	26.8
	1975 prices	400	440	737	798	833	933	18.5
5.	Aerospace & Defence equipments							
	Current prices	490	500	550	620	605	680	6.8
	1975 prices	490	463	459	522	469	428	-2.8
6.	Computers & Calculators							
	Current prices	185	165	170	201	211	294	9.7
	1975 prices	185	161	164	188	194	264	7.5
7.	Electronics industry							
	Current prices	3640	4070	5045	5830	6350	7895	16.7
	1975 prices	3871	3640	4672	5166	5464	6205	11.3

Table 38: Factors contributing to inflation in the different sectors of electronics industry.

Sl. No.	Industry	Rise in cost of compo-nents	Rise in cost of raw materials	Rise in wage and salary	Manufacturing expenses	Rise in energy cost
1.	Components		+	@	@	@
2.	Consumer electronics	+	0	0	0	–
3.	Telecommunication and communication equipment	@	+	@	@	0
4.	Aerospace and defence	@	+	@	@	0
5.	CME	@	+	@	@	0
6.	Computers	+	@	@	0	0

\+ Strong
@ Moderate
0 Less
– Marginal

figure, reflecting thereby that inflation has been increasing with time. The real growth rate in different sectors of electronics industry has also not been uniform. It has varied from 3.9 per cent to 21.2 per cent for various sectors of electronics. The highest growth rate is in consumer electronics followed by CIIE. However, a stragnancy has been observed in the areas of telecommunications and mass communication and aerospace and defence, which indicate that production in these areas has not grown in real terms. There have been different factors, some contributing more and some moderately to inflation in the different sectors of electronics industry as discussed in the previous section. However, qualitative idea of different factors contributing to inflation/price increase in different sectors of electronics industry is summarised in Table 38. The annual growth rates of production of electronics industry during the period of 1975-80, are given in Table 39. The growth rates have been fluctuating with a peak growth rate in 1976-77. The growth rates obtained by time average fitting of growth pattern(similar to Fig. 2) of aggregate electronics industry and individual sectors are given in Table 40.

Table 39. Annual growth rates of production of electronics industry and GNP at current price level and at constant price level of 1975.

Period	Growth rate (%)			
	At current prices		At prices level of 1975	
	Electronics industry	GNP	Electronics industry	GNP
1975-76	11.8	8.1	6.3	3.8
1976-77	24.0	9.8	20.0	7.2
1977-78	15.5	9.8	10.5	5.3
1978-79	8.9	9.2	5.7	4.0
1979-80	24.2	N.A.	13.6	N.A.
Compound growth rate (%)	16.7	8.8	11.3	2.1

Table 40. Comparison of real growth rate with projected time average rate at 1975 prices.

Sl. No.	Sector	Growth rate (%) Real	Averaged
1.	Components	11.1	11.2
2.	Cosumer electronics	21.1	20.5
3.	Telecommunication and mass communication equipment	3.9	5.0
4.	Aerospace and defence equipment	-15.0	-2.5
5.	Computers and controls and instrumentation	18.5	19.0
6.	Aggregate electronics industry	11.3	11.5

Price Trend in the International Market

A comparison of average units prices of some of the selective produced items in India with that in the international market (Table 41 and 42) reveals that price trend in India has not followed

Table 41. Trend in average unit prices of some consumer electronics items in Japan and India during 1975-80 (Value in Rs.)

Sl. No.	Item	Unit prices 1975 Japan	1975 India	1980 Japan	1980 India
1.	Radio receiver (general)	125	160	110	165
2.	B/W TV receiver	785	2250	692	1800
3.	Tape recorder	495	700	467	550
4.	Calculators (4 operation)	125	350	65	150

SOURCE: JEE

Table 42: Comparison of trend in average unit prices of some components in Japan and India between 1975-80 (Value in Rs.).

Sl. No.	Item	Unit prices			
		1975		1980	
		Japan*	India	Japan*	India
1.	Transistor	1.25	2.19	1.20	2.08
2.	(i) Germanium	1.60		0.80	
	(ii) Silicon				
3.	Integrated circuit	13.00	30.00	5.00	20.00
4.	Variable resistor	1.96	3.75	1.70	5.00
5.	Carbon film resistor	0.08	0.09	0.05	0.12
6.	Metal film resistor	0.49	1.91	0.27	2.59
7.	Aluminium electrolytic cap.	0.55	1.29	0.45	2.13
8.	Tantalum capacitor	1.37	13.88	1.13	14.39
9.	Ceramic capacitor				
	(i) 4"	4.40	7.00	7.00	8.00
	(ii) 4"	15.00	18.00	20.00	22.00

the international trend. Unlike India, the prices of electronics items in the international market have shown a steady decline in almost all the items, e.g., average unit prices of carbonfilm resister and semiconductor devices (silicon) which were Rs. 0.08 and Rs. 1.60 in 1980. Similarly the average unit price of black and white white TV decreased by about 13 percent in Japan period. It is estimated that average unit prices of corresponding items (except that of TV) in India have increased by about 30 per cent during the same period. It is estimated that average unit prices of decreased electronics items in the international market have an average by about 10-12 per cent between 1975-80. However, the average increase in prices of components and equipment in India has been of the order of 25 per cent only.

Growth of Electronics Industry in Relation to GNP

The growth of electronics industry, both in equipment and component sectors is related to the growth of industrial activity and hence to the growth of GNP. A comparison of annual growth rates of electronics industry and GNP both at current prices and at a constant price level of 1975 is given in Table 39. The comparison shows that in these years in which growth rate of GNP dropped and in the years, in which growth rate of GNP rose, the growth rate of electronics industry also showed relatively increase but in absolute terms, the growth rates of electronics industry are higher than that of GNP. Similar is the case for annual growth in real term in two cases. Over the period of 6 years, GNP registered a growth rate of 8.8 per cent and 2.1 per cent as compared to rate of 16.7 per cent and 11.3 per cent of electronics industry at current prices and at

1975 price level, respectively. This indicates that inflationary trend in the electronics industry has not followed the general inflation trend of industry and considerable part of growth in electronics industry is on account of real increase in production.

Although in general, the electronics industry has been affected by inflation, it has been benefited from the improvement in technology and manufacturing methods which have kept the increase in prices to a minimum level. The overall growth of electronics industry is not a result of spurt in some particular sector but as as result of fairly uniform contribution from all sectors of electronics industry.

Projection of production for the Year 1984-85 Based on Past Trends:

The sixth Five Year Plan envisages a production of Rs.18215 million (excluding SEEPZ) of electronics items in the year 1984-85. The total electronics industry is projected to grow at a compound rate of 22.7 per cent and its sectors from 15 per cent to 40.4 per cent. However, the past trend indicate that in real terms the electronics industry has grown at the growth rate of 11.3 per cent. The growth of different sectors of electronics have varied between 3.9 per cent to 21.2 per cent. It is observed in most of the sectors that there has not been any quantum jump in production during the period 1975-80. If this trend is an indicator, then growth in production during the next few years is also expected to occur in a similar way. A comparison of production values for 1984-85 projected on the basis of growth trend during 1975-80 with those set out in Sixth Five Year Plan is given in Table 43. It is

projected that production will grow to a level of Rs. 12570 million which will leave a big shortfall in the target value of total electronics production. Thus if the Sixth Five Year Plan targets are to be realised in real term, it would require to take some additional measures to augument the production.

Table 43. Comparison of production projected on the basis of past trends with that of the targets set out for 1984-85 in the Sixth Plan (value in Rs. million).

Sl. No.	Sector	Actual production 1979-80	Projected production for 1984-85 based on past trends	Sixth plan production target for 1984-85
1.	Component	1400	2370	3950
2.	Consumer electronics	1994	5040	5225
3.	Telecommunication	1305	1520	3410
4.	Aerospace and defence	610	710	1230
5.	CIIE	1150	2690	3500
6.	Computers	165	240	900
	Total	6574	12570	18215

V. CONCLUSIONS

The results of the analysis presented in this dissertation are summarised below:

1) During the period 1975-80, the production of electronics industry has grown from Rs. 3640 million to Rs. 7895 million at current prices showing a compound growth rate of 16.7 per cent. The production of equipment has grown from Rs. 2890 million to Rs. 6265 million registering a compound growth rate of 16.7 per cent.

2) The growth rates at current prices in the individual sectors are quite different from that of the growth in the aggregate industry. CIIE sector grew rapidly with a rate of 26.8 per cent, followed by consumer electronics with a growth rate of 21.1 per cent. The growth rates for the other sectors of electronics industry are: Components - 16.8 per cent. Telecommunications and mass communication - 13.1 per cent. Aerospace and defence - 6.8 per cent.

3) For almost all types of equipment and components a price increase has been observed during the last six years. In many cases, valuewise production has increased at much faster rate than the output in physical terms. There have been various reasons for the price increase of electronics items. Important among those being increase in cost of raw material and components rise in wages and salary bill, rise in manufacturing expenses etc. In case of organised sector, the increase in labour cost is quite significant than the small scale sector. The other factors like increase in rate of interest on borrowings and import duty have also contributed appreciably in increasing the cost of production.

4) Aggregate electronics industry: As compared to 16.7 per cent growth in the electronics industry at current prices during 1975-1980, the real growth, i.e., at price level of 1975 has been only 11.3 per cent. The production in real term has increased from Rs. 3640 million to Rs. 6205 million as compared to Rs. 7895 million in apparent terms. About 5.4 per cent growth in production is attributable to inflation. The real growth rates for different sectors of electronics industry has varied between 3.9 per cent to 21.2 per cent. The highest growth rate in real terms is in consumer electronics followed by CIIE sector.

On an average the prices of components and equipment increased by 25 per cent between 1975-1980.

5) Components: The components industry geww at a compound rate of 11 per cent at 1975 prices as compared to a growth rate of 16.8 per cent at current prices. The impact of inflation on different categories of components is different. In the case of electron tubes, prices of TV picture tubes has fallen during this period. though there is a price increase for some types of tubes, the growth rate of electron tube production has not been affected significantly by the inflation. The prices of all types of semi-conductor devices has fallen, as a result this subsector of the components industry has shown real increase in production.

The passive components industry has been affected maximum by the price increase. This increase is mainly attributed to the considerable increase in the prices of raw materials. Moreover, the price increase is observed to be more in the case of organised

sector produced components as compared to the increase of small scale components.

The prices of some of the electromechanical and other components like TV tuners, TV deflection coals have fallen by 25 to 30 per cent between 1975-1980.

6) Consumer electronics: The growth rate in real term at a price level of 1975 has been 21.2 per cent as compared to a growth rate of 21.1 per cent at current prices. The maximum growth rate of 39.6 per cent has been observed in 1976-77. A large share of growth in this sector is accounted by radio and TV receivers. The volume of production of these two items in real terms averaged 80 per cent of total real production of consumer electronics.

Impact of inflation has been minimum in this sector. The rise in raw material cost, labour cost and other overhead expenses have increased the cost of production by about 10.3, and 5 per cent, respectively. However, the productivity gain has absorbed the increase in cost of production. As a result, unit prices of most of the items during the last six years have either remained practically at the same level or have been reduced. But in case of record players and PA systems prices have increased appreciably by about 20 to 25 per cent between 1975-1980.

7) Telecommunication, mass communication, and aerospace and defence: These two sectors of electronics industry have been affected most by the inflation. While for telecommunication equipment, the growth rate of production in real terms at price level, the real growth in aerospace and defence equipment has

been 3.9 per cent as compared to 113.1 per cent growth rate at current price level, the real growth in aerospace and defence equipment has been observed to be negative (-)2.8 per cent. In real terms the production of these two sectors was stagnant during 1975 and 1979. While for telecommunication it increased in 1980, the production in aerospace and defence sector in 1980, declined even below the level of 1975. In subsectors of telecommunications, negative growth rate has been observed in cross bar exchange equipment and growth rate in strowger exchange is almost negligible.

The prices of most of the items in these sectors have increased by about 40 to 50 per cent between 1975-1980.

The cost of raw materials and components, wages and salaries bill, and other direct manufacturing expenses have increased by about 60-70 per cent, 50 to 55 per cent and 60 per cent, respectively between 1975-1980. These have individually, between 1975-1980. These have individually caused the increase in cost of production by about 24 per cent, 15 per cent and 10 per cent respectively.

For most of the public sector units, the ratio of production to inventory has increased by about 12 to 35 per cent between 1975-1979. This inventory accumulation have caused considerable payment of interest thereby increasing the cost of production.

In case of ITI, the major producer of telecommunication equipment, the productivity has increased by 10 per cent while the wages and salary bill and manufacturing expenses increased by 60 per cent between 1975-1980. Similarly, in case of BEL, the former has increased by about 28 per cent while the latter showed an increase of about 60 per cent.

8) Control, Instrumentation and Industrial Electronics: The real growth rate in CIIE sector has been 18.5 per cent as compared to 26.8 per cent at current price level.

The prices of instruments have increased on an average by 30 to 40 per cent between 1974-1980. The prices of medical electronics equipment have increased by about 25 to 30 per cent, test and measuring instruments by 40 to 50 per cent. The price increase in other subsectors of CIIE is also of the same order.

The increase in the cost of raw materials and components by about 40 to 60 per cent between 1975-80 have increased the cost of production by 20 to 25 per cent approximately. Similarly increase of 30 to 35 per cent wage bill and 35 to 40 per cent manufacturing cost have increased the cost of production by about 15 to 20 per cent.

There is a increase in number of units doing manufacturing activity and existing units have also diversified the product range.

9) Computers and calculators: The growth in production of computers and calculators in real terms, i.e., at 1975 price level is 7.5 per cent as compared to growth rate of 9.7 per cent at current price level.

The prices of all types of calculators have declined during the last six years.

The price of 8 bit microcomputer have increased by about 20 to 25 per cent between 1975-80. The rise in prices is mainly on account of increase in raw materials and sub-assemblies. On an average the peripherals have registered and increased of about 35

per cent during the last six years. However, the increase in wages and other overhead expenses has been compensated by the productivity gain.

10) The production of electronics industry, according to the Sixth Five Year Plan (1980-85) is envisaged to grow to a level of Rs. 18215 million. However, looking at the past trend, production of the industry is anticipated to grow only to a level of Rs. 12570 million leaving thereby a big short fall. It would be thus necessary to take some additional measures to meet the production targets set out in the Sixth Five Year Plan.

11) There is now growing awareness about electronics in India. The production techniques, the performance cost ratio has improved in almost all sectors of electronics. The production is based on improved technology and there is a greater usage of integrated circuit based design.

Appendix - 1

Growth in the Production of Some Selected Components During 1975-80 (Value in Rs. million: quantity in million numbers)

Sl. No.	Component		1975	1976	1977	1978	1979	1980	Compound growth rate (%)
1.	Transmitting tubes	Qty.	7100	9400	10400	9870	8977	10400	7.9
		Value	14.84	15.90	16.12	17.15	19.38	20.41	6.6
2.	Microwave tubes	Qty.	180	260	190	255	249	250	6.8
		Value	2.78	3.16	3.52	4.21	3.72	4.76	11.4
3.	Cathode ray tubes	Qty.	900	700	1160	1617	2306	3340	33
		Value	0.41	0.61	0.64	0.79	1.12	1.53	22
4.	X-ray	Qty.	1080	1320	1311	1320	1513	2000	13.1
		Value	5.61	8.57	9.98	9.98	12.47	16.01	23
5.	Metal film/metal oxide film resistors	Qty.	0.74	1.15	0.96	1.37	1.98	1.83	17.8
		Value	1.42	2.74	2.53	3.07	4.28	4.74	27
6.	Wirewound resistors	Qty.	0.96	0.79	0.98	0.98	0.89	0.82	3.2
		Value	0.63	0.77	0.93	1.08	0.83	0.67	1.2
7.	Carbon track/wire wound potentiometers	Qty.	4.08	4.58	5.53	6.76	6.25	6.00	8.0
		Value	8.73	11.24	13.32	24.17	22.25	21.53	19.8
8.	Tantalum capacitors	Qty.	0.35	0.41	0.50	0.49	0.43	0.57	40.3
		Value	4.86	6.27	7.07	6.97	6.54	8.22	11.1
9.	Ceramic capacitors	Qty.	56.98	47.60	64.24	75.66	78.24	77.31	6.3
		Value	12.20	13.28	14.88	20.01	21.01	22.06	12.6
10.	Soft ferrites	Qty (MT)	123.2	150.2	192.6	228.0	215.0	235.7	
		Value	5.5	7.2	6.7	10.9	10.9	16.3	

REFERENCES

1. Annual Reports of the Department of Electronics". Government of India, 1971-72 to 1980-81.

2. "Annual Report", Bharat Electronics Ltd., Bangalore, 1978-89.

3. "Annual Report", Indian Telephone Industries, Bangalore, 1971-72 1972-73, 1978-89.

4. "Sixth Five Year Plan 1980-85". Department of Electronics, New Delhi.

5. "Perspective Report on Electronics in India 1975".

6. Annual Reports", Instrumentation Ltd., Kota, 1971-72 to 1978-79.

7. "Fifth Five Year Plan" Telecommunication and Electronics, March, 1973.

8. "Statistical outline of India", Published by Oxford Press, 1981.

9. "Annual Report", Electronics Corporation of India Ltd., 1975-80.

10. Electronic Commission (IPAG), New Delhi.